FLIGHT
and
The AIRCRAFT ENGINEER

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The Outlook

The Air Exercise

THE air exercise which (as described in *Flight* last week) took place from August 8 to August 11 was an exercise and not manœuvres. That is the main point which all should keep in mind. It was meant to give everybody lots of practice, and also to try out certain ideas which it would not be advisable to mention, but not to prove whether air defence is stronger than air attack or the reverse. Any attempt to draw conclusions of that sort must be waste of energy.

To begin with, there was a patent agreement between Eastland and Westland that the former should give as much practice to the latter as possible. There was no strategic plan to be discerned behind the operations of the bombers. They did not concentrate their attacks but spread them as far and wide as possible. For instance, one raid attacked Salisbury and found it strongly defended. In real war it would be very surprising if the enemy thought it worth while to attack Salisbury, and if he did he would be even more surprised to find it strongly defended. Eastland bombers in this exercise flew where they knew defence was to be found. The allotted targets had been so arranged.

Allowing for this basic unreality, certain tactical lessons may be drawn from exercises, though only the senior officers of the R.A.F. who see all the detailed reports are in a position to learn all those lessons. The main thing which everybody wants to know is, within the limits imposed, what proportion of raids was intercepted by fighter aircraft. That exact figure will not be published, but we are assured that it is a high one, and all the personal investigations which it has been possible to make point in the same direction. That is a distinctly comforting thought.

By day, if the weather is clear, gunners on the ground can spot raiders more easily than fighters in the air can spot them, and the bursts of the shells are one of the main guides to the fighter patrols. Although the A.A. gunners were on duty throughout this exercise no shells were fired, and so the fighters were without this help to interception. In war this help would not be absent, and so a still higher proportion of interceptions would be almost certain.

Effect of the Weather

THE exercise opened in weather such as a bomber commander might dream of and pray for. There were plenty of clouds with plenty of breaks in them. Even British weather will not always be so accommodating to raiding bombers. The Eastland pilots exploited the conditions to the full, and one official report says that they "made expert use of cloud formations and skilfully avoided many searchlights." It is not always realised that to make a successful raid calls for experience, tactical skill and a high degree of leadership. The bombers of the R.A.F. displayed all those qualities during this exercise, and we may well be proud of them. Though the weather helped their tactics, this flying in the most difficult conditions was a strain, and the pilots and crews must have been tired men when the "cease fire" sounded. Once or twice, so the reports said, there was evidence that perpetual harrying by fighters (the guns did not harry them as they would in war) upset the raiders and led them to drop their imaginary bombs on unimportant places. Real enemies would be much more severely harried.

When fine weather spread over much of the Midlands during the Thursday-Friday night all pilots must have felt a relief. The advantage then swung round to the

THE OUTLOOK (CONTINUED)

side of Westland, and "the stars in their courses fought against Sisera." The bomber pilots could fly more easily and with less anxiety from the weather, but it became easier to spot them and to intercept them. In the Great War German raiders usually came in fine weather. If there is another war clear skies are likely to be avoided by those who would raid Great Britain. Yet, if cloud banks obscure the targets there is not much sense in dropping bombs at all. The ideal conditions for a bomber are somewhat exacting, and they will not often be so favourable as they were on the Tuesday night of the exercise. On the other hand, if we have to make counter-attacks on an enemy, his defences will have to be very complete if he is to prevent our skilful and determined bomber crews from forcing their way through to their objectives.

Minor Tactics

AS regards minor tactics, it is hard to see how such an exercise can teach anything. An official report says "the exercise has shown that the fighter aircraft is more than a match for the raiding bomber if it succeeds in engaging it." How the exercise can have shown that is a mystery, when no bullets were fired. We know that the fighter is superior in speed and in weight of fire, but until and unless the bombers also open fire with real bullets it is not easy to estimate by practice what the result of the combat will be. Carefully arranged mock combats with camera guns meticulously synchronised will give some grounds for coming to a conclusion, but the flashing of recognition lights, which were the only indication of a combat in these exercises, could not do so.

Air Chief Marshal Sir Hugh Dowding, who commands the defence, was far less committal in his broadcast afterwards, though he was very optimistic, and rightly so, about the chances of bringing "an air attack on these islands to a standstill within a short space of time."

Observation Balloons

UP to a few months ago there was a balloon training unit stationed on Salisbury Plain, where observers and crews were trained in the use of observation balloons for army co-operation. That unit no longer figures in the *Air Force List*, and has presumably been disbanded. Consequently, though the Fighter Command has plenty of barrage balloons, whose function is to raise a forest of cables for the discouragement of low-flying raiders, there are no balloons intended to take up observers for a good look round from a fixed point. We seem to have abolished a weapon of defence which had distinctly useful possibilities.

The recent black-out of London had to be postponed from the Wednesday night to the Thursday, because on the Wednesday the clouds were too low for the observation aircraft, which were to take up the A.R.P. observers, to fly with safety below the cloud base. Had suitable balloons been available, the observers could have gone up to a sufficient height at several points and have gained the information which they needed.

For army reconnaissance the aeroplane has the advantage over the balloon, but the latter could still do some useful work, as it did in the late war. For air defence, balloon observers, protected by guns, by barrage balloons, and by parachutes, might be able to supplement the reports of the Observer Corps as to the movement of raiders, and we cannot afford to dispense with any source of information.

Perhaps the strongest case for the observation balloon is its utility in marine convoys, where it scored a success in the Great War when towed by a ship. Modern A.A. guns could give it formidable protection, and there is always the parachute as a last resource. Air observation, working in collaboration with the escort vessels, is what the submarine commander most dreads.

Many authorities consider the non-rigid airship to be more useful than the aeroplane for this work because of its lower speed, and the towed balloon has the same advantage as the airship. If balloons could take over convoy work and set a number of aeroplanes free for other duties, the country would be the gainer. But this cannot be done unless we have the balloons and the trained crews. The Admiralty might well pay some attention to this possibility.

Why Not a Hundred?

THE daily papers have drawn a good deal of attention to the air transport of 120 men of the Royal Ulster Rifles from Ryde to Axford. It took six flights by Bombay bomber-transport machines to transport this small number of troops—though, of course, we must not forget their steel helmets and rifles which the reporters emphasised that they took with them. Machine guns, if any, presumably followed by boat and train.

The Bombay aeroplane is a very fine one, and we have nothing against it as an aircraft. The specification was drawn up by the Air Ministry. But in these days it is surely rather ludicrous to build transport aircraft which can only carry up to twenty-five soldiers. If the 120 riflemen were carried simultaneously in six Bombays, the performance could only be called a very extravagant use of aircraft. If two or three Bombays made two or three journeys each, there was a great waste of time.

If we are seriously contemplating the transport of troops by air in modern warfare as apart from the repression of Cypriot rioters or Iraki mutineers, it seems very absurd that we should think in terms of twenty-five-seaters, when commercial air companies are dealing (or about to deal) with fifty or more passengers at a time and are giving them luxurious accommodation. If the Air Ministry will order really large transport aircraft the trade will be able to supply them. We should like to know whether the War Office has asked for machines of this type.

It is some three years since King Edward VIII inspected the prototype Bombay at Martlesham, so the War Office has no excuse for not knowing what the Air Ministry was doing in the matter of transport machines. Is this, we wonder, another instance of lack of co-ordination between two fighting Ministries? If so, we recommend the case to the earnest attention of Lord Chatfield.

DIARY OF FORTHCOMING EVENTS—PAGE 178.

JU.90—ANGLE 1 : A unique study of the big four-engined Junkers Ju.90 transport, which is often to be seen at Croydon, showing the unusual shape of the wing.

The Imperial Hiatus.

NOT until the recent admission of Imperial Airways that they were unable to deal with the increasing Empire loads had it been fully realised that an enormous amount of the all-up mail is carried unnecessarily.

During the early months of the scheme we were often told by business people that the whole thing was more of a nuisance than an advantage, but we discounted such remarks as those of rigid conservatives who would eventually discover the true value of the scheme. Just the same amount of trouble would be occasioned by a simple change in the charges made for the surface transport of mail.

But the complaints which have more recently been made are more in the nature of suggestions for relieving the pressure. Obviously, quite a large number of letters are sent unnecessarily by air—letters for which acceleration is a pure luxury. In addition, an unexpectedly large proportion of the air-mail loads seems to be taken up with "safety" copies of letters which have already been sent. That is the inevitable result of a series of accidents involving the mail loads.

Certainly, there seems to be a reasonable argument in favour of a greater degree of self-determination. While all ordinary letters can still be sent by air, copies and less important packages could reasonably, and without "loss of face," still be sent by sea.

In the meantime, it seems that the Air Ministry is to set up a committee to look into the possibility of using long-range bombers for special mail-carrying duties. If the decision is favourable, there will be absolutely no need for Imperial Airways to turn to America.

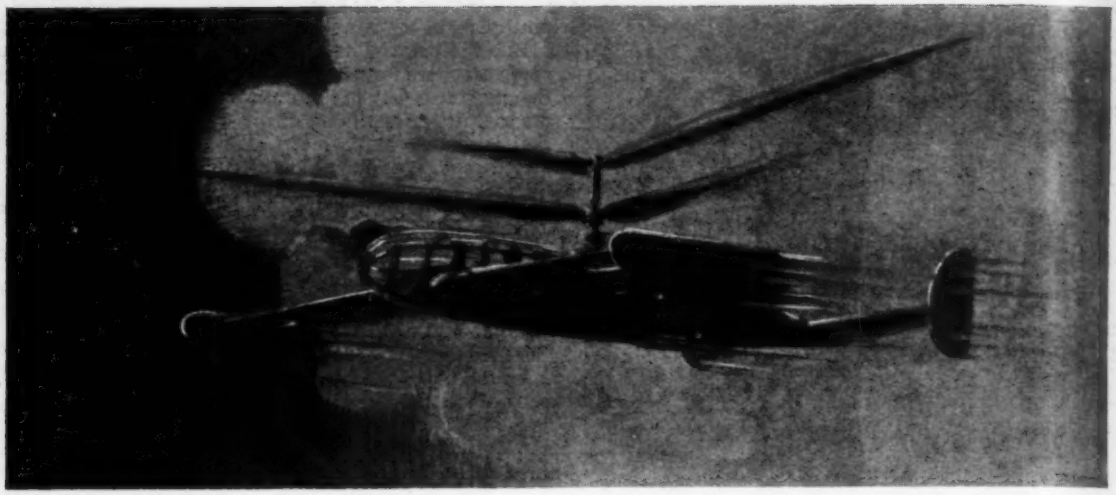
Worth Developing

A FEW weeks ago we pointed out that the rumour that an order had been placed by the Air Ministry for an Asboth helicopter was premature. There is, however, every likelihood of such an order being placed, and negotiations may be concluded very soon. In the meantime *Flight* has discussed his designs with Mr. von Asboth, and an article appears on the following pages.

It will be seen that the Asboth rotor principle, which is an adaptation of airscrew design, has important advantages compared with the rotor in which the angle of attack of the blades is constant from root to tip. Not only is the maximum lift obtainable very considerably greater, but what is equally important is that the powerful torque exerted by the negative tip angles ensures autorotation under all conditions. In fact, the rotor speed increases with sinking speed and prevents loss of lift.

The performance figures for the A.H. X are seen to be remarkably good. In addition to those published in the article it may be added that the same machine at a gross weight of 3,960 lb. has an initial rate of climb of about 2,000ft./min., and reaches 10,000ft. in 4 min. 40 sec., and 20,000ft. in 10 min. 30 sec. all in vertical climb.

JU.90—ANGLE 2 : Due to the perspective it is difficult to reconcile this view of the Ju.90 with that shown above. It shows, among other things, the Junkers so-called "double-wing" arrangement.



An artist's somewhat impressionistic idea of how the Asboth helicopter will appear in flight.

REAL HELICOPTER PROGRESS

Spectacular Performance of the Asboth Designs : Machine to be Built in England

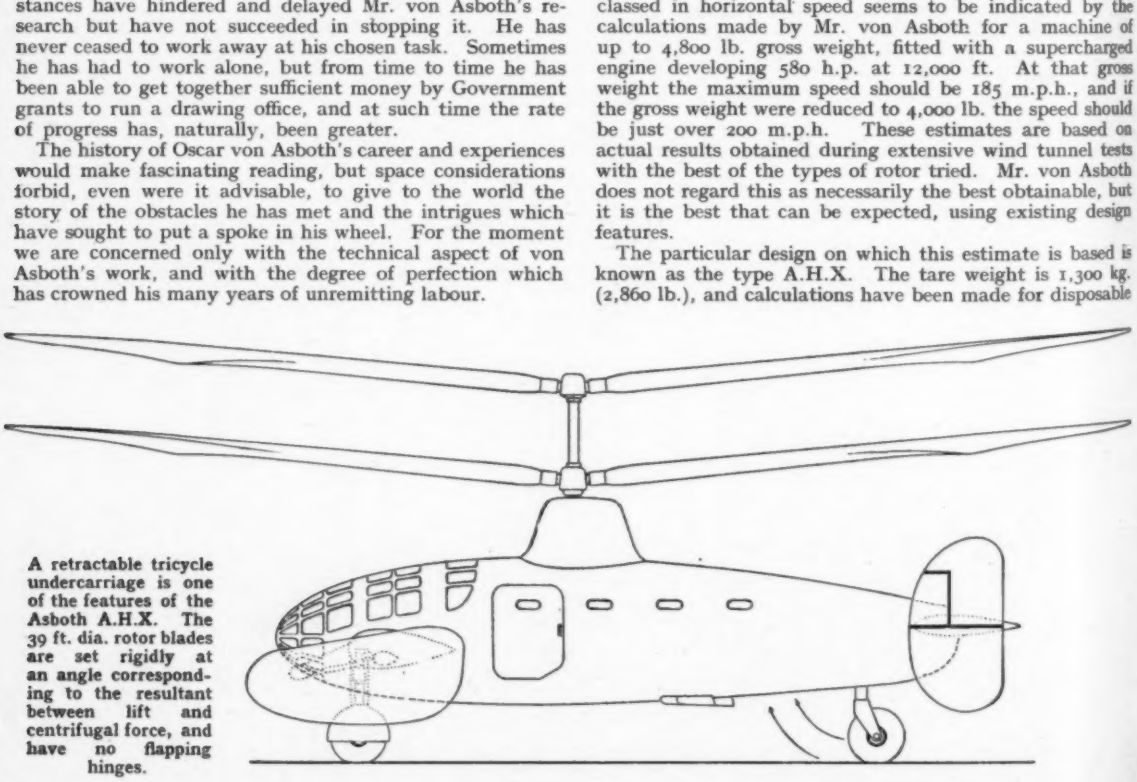
By THE EDITOR

FOR many years *Flight* has followed with interest the work of the Hungarian aeronautical engineer Oscar von Asboth, who has long been associated with helicopter research, and who as early as 1918 built a three-engined captive helicopter which ascended on several occasions and during one flight reached a height of 50 metres (about 160 ft.). Political and financial circumstances have hindered and delayed Mr. von Asboth's research but have not succeeded in stopping it. He has never ceased to work away at his chosen task. Sometimes he has had to work alone, but from time to time he has been able to get together sufficient money by Government grants to run a drawing office, and at such time the rate of progress has, naturally, been greater.

The history of Oscar von Asboth's career and experiences would make fascinating reading, but space considerations forbid, even were it advisable, to give to the world the story of the obstacles he has met and the intrigues which have sought to put a spoke in his wheel. For the moment we are concerned only with the technical aspect of von Asboth's work, and with the degree of perfection which has crowned his many years of unremitting labour.

Performance, in the form of horizontal speed, is of no great importance in helicopter operation. If it is there, so much the better. But the ability to ascend and descend vertically, and to hover indefinitely, is a quality not shared by the fixed-wing aeroplane, so that a small loss in maximum horizontal speed is not a high price to pay for it. That the helicopter need not necessarily be hopelessly outclassed in horizontal speed seems to be indicated by the calculations made by Mr. von Asboth for a machine of up to 4,800 lb. gross weight, fitted with a supercharged engine developing 580 h.p. at 12,000 ft. At that gross weight the maximum speed should be 185 m.p.h., and if the gross weight were reduced to 4,000 lb. the speed should be just over 200 m.p.h. These estimates are based on actual results obtained during extensive wind tunnel tests with the best of the types of rotor tried. Mr. von Asboth does not regard this as necessarily the best obtainable, but it is the best that can be expected, using existing design features.

The particular design on which this estimate is based is known as the type A.H.X. The tare weight is 1,300 kg. (2,860 lb.), and calculations have been made for disposable



A retractable tricycle undercarriage is one of the features of the Asboth A.H.X. The 39 ft. dia. rotor blades are set rigidly at an angle corresponding to the resultant between lift and centrifugal force, and have no flapping hinges.

loads of 500 kg. (1,100 lb.), 700 kg. (1,540 lb.), and 900 kg. (1,980 lb.). As one of the graphs shows, the rate of climb is extraordinarily high (for instance, the first 3,000 ft. takes only about two minutes at the greatest gross weight, 4,840 lb.), and is maintained up to considerable heights. The absolute ceiling is 5,800 metres (19,000 ft.) with the engine mentioned above.

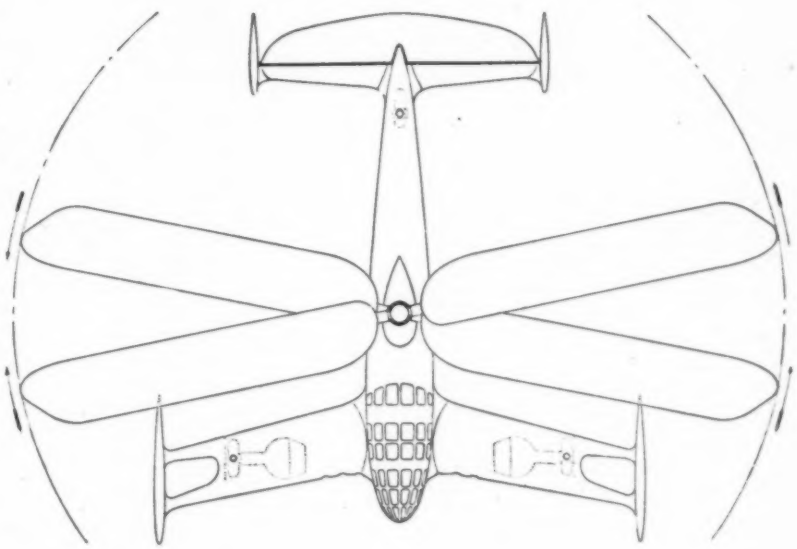
Autorotation is, of course, an essential feature of any helicopter design. If this is not present, the machine will fall like a stone when the engine stops. In the Asboth designs autorotation is ensured automatically and instantaneously; how this is done we are not permitted to explain at the present time, but we have seen the drawings and there is no doubt that the change in incidence which is necessary for autorotation to take place is ensured.

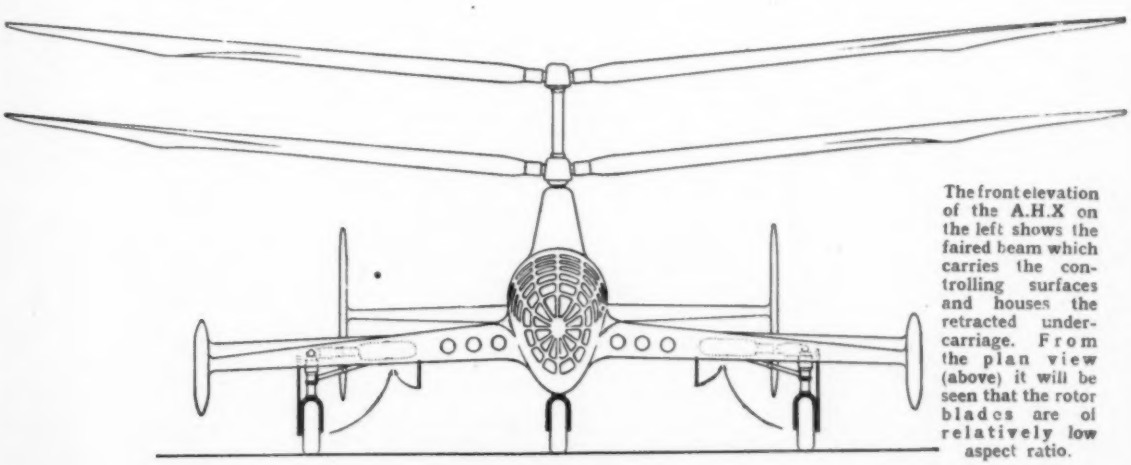
Another graph shows the different rates of descent obtained at different angles of the flight path. As was to be expected, this rate is highest when the angle of the glide path is greatest, viz., when the machine is descending vertically. At the maximum gross weight it is in the region of 41 ft./sec. But it is, of course, quite possible to employ the same landing technique as that used with the Autogiro and so reduce the vertical velocity by dropping the tail just before touching down. As soon as the glide path is inclined, that is to say as soon as the machine moves forward, the rate of descent in the glide is greatly reduced, and it reaches a minimum when the angle of the flight path is about 13 degrees, when the rate of gliding descent is roughly that of a parachute, i.e., 16 ft./sec. Thus it should be easily possible to make a safe forced landing with the engine stopped completely.

If certain negotiations at present being carried out do not fall through, and there is no reason to think that they will, an Asboth helicopter will be built in this country. I am not at liberty to disclose the identity of the firm which is to build it until all the parties concerned have signed on the dotted line. That may happen at any moment.

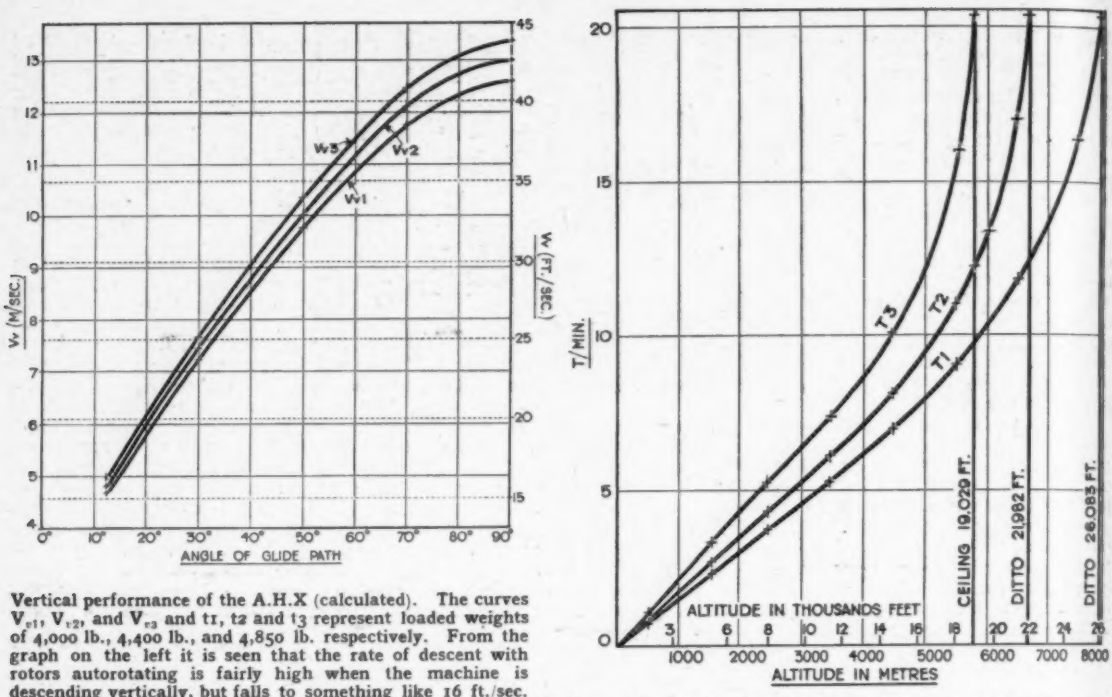
An early Asboth helicopter was the A.H.4 seen on the left. It was flown on more than one occasion by Capt. R. N. Liptrot of the British Air Ministry.

The machine which is to be built in this country is a variation of the Asboth type A.H.6. The engine to be fitted will probably be a Gipsy Six II of 200 h.p., and the following data have been calculated for it: Rotor diameter, 33.5 ft.; area or rotor disc, 1,023 sq ft.; weight empty, 1,763 lb.; disposable load, 385 lb.; loaded weight, 2,148 lb.; lift (calculated on previous rotors) 3,260 lb.; excess of lift 1,100 lb.; rotor efficiency (calculated according to the Bendemann formula) 0.85; rotor disc loading (autorotation), 2 lb./sq. ft.; rotor disc loading (at greatest power-driven lift), 3 lb./sq. ft.; power loading 11 lb./h.p.; maximum initial thrust, 1,540 lb.; maximum horizontal speed, 107 m.p.h.; ceiling 11,500 ft.; initial rate of climb, 1,760 ft./min.; 3,300 ft. in 2 mins; 6,600 ft. in 5 mins.; 10,000 ft. in 9 mins. 40 secs.; 11,500 ft. in 18 mins.;





The front elevation of the A.H.X on the left shows the faired beam which carries the controlling surfaces and houses the retracted undercarriage. From the plan view (above) it will be seen that the rotor blades are of relatively low aspect ratio.



Vertical performance of the A.H.X (calculated). The curves V_{t1}, V_{t2}, and V_{t3} and t1, t2 and t3 represent loaded weights of 4,000 lb., 4,400 lb., and 4,850 lb. respectively. From the graph on the left it is seen that the rate of descent with rotors autorotating is fairly high when the machine is descending vertically, but falls to something like 16 ft./sec. when the gliding path is 13 degrees. The rate of climb at all loadings, shown in the right-hand graph, is remarkably high, and the ceiling is good. The times represent vertical ascent. If the flight path is inclined forward the rates of climb become even better.

minimum rate of descent (autorotation) 14 ft./sec. Lift coefficient by autorotation 1.5.

These figures indicate that Mr. von Asboth has progressed a very long way towards a helicopter with a really practical performance. How he has attained this achievement may not be explained in detail at the moment. I have, however, had the privilege of examining his drawings, and the so-called four-function hub which he has designed is neither complicated nor difficult to manufacture. In outline it may be said that the blades are set rigidly on the hub at an angle to the horizontal plane. That is to say, they have no flapping hinges. The angle is such that it represents the resultant between centrifugal force and lift when the machine is hovering, i.e., when there is no forward speed. Under other conditions there is a residual torque moment, but this is not of great magnitude and is taken care of in the design of the hub.

A Four-function Hub

As the name implies, the Asboth four-function hub performs four duties, three of which are entirely automatic while the fourth is represented by the pilot's manually-operated control. The oppositely rotating rotors tilt out of the horizontal plane when the machine moves forward, but as the lower can be regarded as the mirror image of the upper rotor, balance is maintained. The angle of incidence is automatically changed to give autorotation the instant the engine speed is reduced. And the hub automatically compensates for sudden changes of the relative wind, such as will be caused by gusts, for example. The pilot's control tilts the planes of the rotors and thus causes the machine to hover or move forwards.

When we are in a position to publish the drawings it will be seen that the Asboth four-function hub is probably the simplest and smallest ever designed so far.

Although the four-function hub is an extremely important part of the Asboth design, it would not by itself give the remarkably high performance which calculations have indicated to be attainable. The secret of this is to be found in the aerodynamic design of the rotor blades. As a result of his long years of research, experiment and mathematical investigations (the latter of which were discussed in great detail with the late Mr. Glauert of the Royal Aircraft Establishment), Mr. von Asboth has come to the conclusion that the type of rotor in which the blade incidence is constant along the span does not and cannot give maximum lift because the lift distribution along the blade is wrong. He claims that an efficiency of only about 0.55 or 0.60, calculated according to the Bendemann formula, is possible, whereas with his design of blade efficiencies as high as 0.85 have been proved attainable.

The drawings of the A.H.X. published herewith give some slight hint of the Asboth blade design. It will be noticed that the aspect ratio is relatively low, a fact which should help to reduce rotor weight, since the large blade chord results in room for a deeper spar. But that is by no means the real secret. What in effect Mr. von Asboth has done is to use a blade which is a variation of the familiar airscrew blade, with an inner portion normally set at no angle of incidence, a middle portion set at a small positive angle, and a tip portion set at a negative angle.

Lift is, of course, derived mainly from that portion which is set at a positive angle of incidence. As it is situated fairly far out from the hub, it is travelling fast and thus giving a high lift. The extreme tip contributes little or nothing to the lift, but when autorotation sets in, the negative angle of the tip gives a very powerful torque and maintains autorotation even under conditions in which the constant-angle type of rotor would stop, or at least slow down to a dangerous extent.

Excellent Autorotation

Mr. von Asboth has tested numerous blade forms in a wind tunnel specially constructed for rotor tests. Finality has certainly not been reached, and the already excellent autorotation can be further improved. An important feature of the Asboth rotor system is that rotor speed, and, therefore, lift, increases with sinking speed, so that it is impossible for the machine to "fall out of the air."

The drawings published herewith show the A.H.X type of Asboth helicopter. They are in the main self-explanatory, but it might be pointed out that the wing-like structure in front is merely a streamlined beam for carrying the control surfaces. At the same time it houses the retracted undercarriage. The A.H.6 will, it may be assumed, be of similar appearance. The engine is placed centrally in the fuselage, and a fan will be used for cooling when the machine is ascending vertically or hovering.

THE ROYAL AERO CLUB

News and Official Notices for *the Week Ended August 19*

Nine Hours' Air Racing

FOR nine hours spectators at the Birmingham Airport on September 2 will be treated to almost continuous air racing. The first heat for the King's Cup Race will begin at 9 o'clock in the morning and the final will begin at 5.15 in the evening. Between the start of the first heat and the end of the final there will be five separate races comprising the other heats for the King's Cup and the heats and final for the Wakefield Trophy. The intervals between each race will be kept short. [Times appear on p. 184.—ED.]

Preparations are already well in hand for marking the course and indicating to pilots exactly where they must turn. At each turning point official observers will be posted to ensure that the regulations are observed. Enclosures for the public are being arranged by the Birmingham Airport authorities, who are making special efforts to ensure that the 1939 King's Cup Race shall be a memorable event in British sporting aviation.

Catering is planned on a scale sufficient to enable those who are interested to remain the whole day at the airport and to obtain refreshment when they require it. It has also been arranged for bookmakers to attend the meeting.

Baule Game

WHAT promises to be the best and brightest week-end of the aero year has been arranged by the Aero Club "Jean Mermoz" at La Baule for September 9, 10 and 11. British private owners are invited to go over to this Atlantic seaside resort at the mouth of the Loire, near St. Nazaire, and to stay at the famous Hermitage Hotel as the guests of that club.

The programme of entertainment includes every sort of sport. The Casino will be thrown open to the British guests and there will be golf competitions on the links. Sea temperatures of this part of the Atlantic coast are usually maintained well into September and consequently another attraction will be sea and sun bathing. Last year the La Baule week-end was greatly appreciated by British visitors, and this year every effort is being made to outdo any previous meeting.

Large numbers of British aircraft owners are expected to go, and it will be advisable for those who wish to be included among the guests of the Aero Club "Jean Mermoz" to notify the Royal Aero Club immediately, stating the registration marks of the aircraft and the full names of the pilot and passengers.

(*Concluded on next page.*)

Aviators' Certificates

No.	Name	Club or School	Date
19,448	Robert Cecil McKechney ...	South Coast Flying Club .	10.8.39
19,449	John Victor Tree	South Coast Flying Club .	10.8.39
19,450	Sidney Frederick Polatch ...	Midland Bank Flying Club	10.8.39
19,451	Jack Richard Friend	Norfolk and Norwich Ae.C.	10.8.39
19,452	Reginald Eugene Merceron Burton	Norfolk and Norwich Ae.C.	10.8.39
19,453	Eric Edmund Hesketh	Norfolk and Norwich Ae.C.	10.8.39
19,454	Silvia Mary Newman	Cinque Ports Flying Club	10.8.39
19,455	Margot Irene Duke	Redhill Flying Club ...	10.8.39
19,456	Frank Beswick	Airwork Flying Club ...	10.8.39
19,457	Nathaniel Pearce Hodgson ...	Southend Flying Club ...	10.8.39
19,458	John Henry Case	Midland Aero Club ...	10.8.39
19,459	Ralph Lancelot Aldis	Midland Aero Club ...	10.8.39
19,460	Christopher Frederick Kidd ...	Strathtay Aero Club ...	10.8.39
19,461	Charles Arthur Blackburn ...	Bournemouth Flying Club	10.8.39
19,462	David Murray Lindner	Bournemouth Flying Club	10.8.39
19,463	Beresford Edward Martin ...	Bournemouth Flying Club	10.8.39
19,464	Vera Laughlin	Bournemouth Flying Club	10.8.39
19,465	Harry Warner Johnson	Bournemouth Flying Club	10.8.39
19,466	Alexander David Boddam-Whetham	Bournemouth Flying Club	10.8.39
19,467	Hubert Martyn Richards ...	Bournemouth Flying Club	10.8.39
19,468	Kenneth George Weeks	Bournemouth Flying Club	10.8.39
19,469	Maurice George Webb	Bournemouth Flying Club	10.8.39
19,470	Harry Kenneth Waterfield ...	Royal Air Force F.C. ...	10.8.39
19,471	Grenville Hammerton Shaw ...	No. 43 E. and R.F.T.S., Newcastle.	10.8.39
19,472	Arthur Frederick Underwood ...	County Flying Club ...	11.8.39
19,473	Frederick John Ingram	Norfolk and Norwich Ae.C.	11.8.39
19,474	Stanley Wrigglesworth	York and Leeming F.C....	11.8.39
19,475	William Thomas Dewhurst ...	Blackpool and Fylde Ae.C.	11.8.39
19,476	John Royal Crossley Pratt ...	Liverpool and Dist. Ae. C.	11.8.39
19,477	Colin Douglas Loughlin	Liverpool and Dist. Ae. C.	11.8.39
19,478	William Wilfrid Leete	Liverpool and Dist. Ae. C.	11.8.39
19,479	Robert Francis Swarbrick ...	Romford Flying Club ...	11.8.39
19,480	George David Bunch	Isle of Wight Flying Club	11.8.39
19,481	Maurice William Peters	Plymouth and Dist. Ae. C.	11.8.39
19,482	Peter Richmond	Plymouth and Dist. Ae. C.	11.8.39
19,483	Stephen Albert Vinyard	Ipswich Aero Club ...	11.8.39
19,484	Vincent Frank Griffith	Weston Aero Club ...	11.8.39
19,485	Albert Alonso y Rayneri	Weston Aero Club ...	11.8.39
19,486	Stanley George Henry Randall ...	Reading Aero Club ...	11.8.39
19,487	Cecil Maurice Cooper	Reading Aero Club ...	11.8.39
19,488	Leslie Robert Edwards	Reading Aero Club ...	11.8.39
19,489	Richard Arthur Oliver Blackwell	Reading Aero Club ...	11.8.39
19,490	José Mary Berryman	Reading Aero Club ...	11.8.39
19,491	Jack Mann	Reading Aero Club ...	11.8.39
19,492	Robert Ramsey McKelvie ...	Strathtay Aero Club ...	11.8.39
19,493	Richard Grenville Normanton ...	Wiltshire Flying Club ...	12.8.39
19,494	Robert Read	Wiltshire Flying Club ...	12.8.39
19,495	Leonard Alfred Hurst	Isle of Wight Flying Club	12.8.39
19,496	Bernard Spires	Peterborough Flying Club	12.8.39
19,497	Edward York Bramble	Isle of Wight Flying Club	12.8.39
19,498	Frederick Noel Ralph Ward ...	Isle of Wight Flying Club	12.8.39
19,499	Pauline Alice Grace Knocker ...	Hampshire Ae. C. ...	12.8.39
19,500	Hugh Mason	Norfolk and Norwich Ae.C.	12.8.39
19,501	John Reginald Dunwoody ...	Southend Flying Club ...	12.8.39
19,502	Geoffrey Frank Colman Pledger...	Southend Flying Club ...	12.8.39
19,503	Sydney Hubert Worsley	Tollerton Aero Club ...	12.8.39
19,504	Peter Westlake Walker	London Air Park F.C. ...	12.8.39
19,505	Dorothy Pamela Nelson Shilstone	London Air Park F.C. ...	12.8.39
19,506	Rowland Edward Payne	London Air Park F.C. ...	12.8.39
19,507	George Edward James Reynolds...	Redhill Flying Club ...	12.8.39
19,508	Archibald Charles Morrison ...	Redhill Flying Club ...	12.8.39
19,509	Cyril Leslie Riseman Harris ...	Hull Aero Club	12.8.39
19,510	Thomas William Kean	No. 1 F.T.S., Netheravon	14.8.39
19,511	Henry Christie Landon Sorrell ...	Scottish Flying Club ...	14.8.39
19,512	Philip Gilbert Robinson	Ganton Flying Club ...	14.8.39
19,513	Frank Gordon Warwick Roberts	Southend Flying Club ...	14.8.39
19,514	Roy Arthur Brown	Southend Flying Club ...	14.8.39
19,515	Norman Featherstone	Hull Aero Club	14.8.39
19,516	Frederick William White... ...	North British Aero Club...	14.8.39
19,517	Charles Davidson	North British Aero Club...	14.8.39
19,518	Richard Bradbury...	Autogiro Flying Club ...	14.8.39
19,519	William James Richards	York and Leeming F.C....	14.8.39
19,520	Eric Harrison Berry	York and Leeming F.C....	14.8.39
19,521	Joseph Frederick Woodward ...	No. 16 E. and R.F.T.S., Shoreham.	14.8.39
19,522	Norman Joseph Miller	Scottish Flying Club ...	14.8.39
19,523	John White	Scottish Flying Club ...	14.8.39
19,524	Gilbert Matthew Stephenson ...	Romford Flying Club ...	14.8.39
19,525	Sidney Frederick Cooper	University Aero Club ...	14.8.39
19,526	James Gordon Osler	University Aero Club ...	14.8.39
19,527	Eric Arthur Wilde...	University Aero Club ...	14.8.39
19,528	John Theodore Hanafy	University Aero Club ...	14.8.39
19,529	Patrick James Neil Adshead ...	University Aero Club ...	14.8.39
19,530	Benedict Warren Melvill Jones ...	University Aero Club ...	14.8.39
19,531	John Derek Brearley Rigby ...	University Aero Club ...	14.8.39
19,532	Richard Graham Law	University Aero Club ...	14.8.39
19,533	John Frederick Lendrum... ...	Cambridge Aero Club ...	14.8.39
19,534	Donald Dines	Cambridge Aero Club ...	14.8.39
19,535	John Newman Gallyon	Cambridge Aero Club ...	14.8.39
19,536	Geoffrey Barringer Moss	Cambridge Aero Club ...	14.8.39
19,537	William Richard James	Cambridge Aero Club ...	14.8.39
19,538	Wilfrid Edmund Bircham	Cambridge Aero Club ...	14.8.39
19,539	John Noel Miles Heffer	Cambridge Aero Club ...	14.8.39
19,540	Jeanette Ann McCombie	Cambridge Aero Club ...	14.8.39
19,541	Cephas Merrett Carwardine ...	Cambridge Aero Club ...	14.8.39
19,542	Walter Ernest Rand	Cambridge Aero Club ...	14.8.39
19,543	Ronald George Moy Morgan ...	Midland Aero Club ...	15.8.39
19,544	Farnham Peter King	Midland Aero Club ...	15.8.39
19,545	Iney Vivian McLaughlin	Midland Aero Club ...	15.8.39
19,546	Leonard Eric Newton	Bedford Aero Club ...	15.8.39
19,547	Alan Victor Huckle	Bedford Aero Club ...	15.8.39
19,548	David Wyndham Fry	Bedford Aero Club ...	15.8.39
19,549	Cecil Leonard Smith	Bedford Aero Club ...	15.8.39
19,550	David Thomas	Bedford Aero Club ...	15.8.39
19,551	Kenneth Charles Rogers	London Aeroplane Club...	15.8.39
19,552	Henry John Secker	London Aeroplane Club...	15.8.39
19,553	Henry George Huckle	London Aeroplane Club...	15.8.39
19,554	Peter William Stanley	Luton Flying Club ...	15.8.39
19,555	Palemon Plant	Airwork Flying Club ...	15.8.39
19,556	Richard John Roach	Cinque Ports Flying Club	15.8.39
19,557	Norman Driver	Yorkshire Aeroplane Club	15.8.39
19,558	Edwin John Ford	Southend Flying Club ...	15.8.39
19,559	Albert Enticknap	Horton Kirby Flying Club	15.8.39
19,560	Herbert Robert James Adams ...	Horton Kirby Flying Club	15.8.39
19,561	John Hampshire	Horton Kirby Flying Club	15.8.39
19,562	Cyril Bridge	Horton Kirby Flying Club	15.8.39
19,563	Harold Kedwards Smallwood ...	Horton Kirby Flying Club	15.8.39
19,564	William George Henry King ...	Horton Kirby Flying Club	15.8.39
19,565	Christopher Dent	Horton Kirby Flying Club	15.8.39
19,566	Cuthbert Gylby Hutchinson ...	Barnstaple and N. Devon Flying Club.	16.8.39
19,567	Ronald Royal Paine	South Coast Flying Club...	16.8.39
19,568	Thomas Kyd Lockhart	Strathtay Aero Club ...	16.8.39
19,569	George Frederick Hann	Midland Aero Club ...	16.8.39
19,570	Leonard Dumolo	Midland Aero Club ...	16.8.39
19,571	Stanley Parker	Midland Aero Club ...	16.8.39
19,572	Jack Wilk	Midland Aero Club ...	16.8.39

The Royal Aero Club (Cont.)

Air Guides

NOTABLE enterprise has been shown by the Swiss Aero Club and the Royal Danish Aero Club in issuing two special Air Guides written entirely in English. The object of the guides is to promote private flying to and in the countries concerned and a large amount of useful information is given.

There are maps and tables, plans of aerodromes, and notes on the various places which people might wish to visit. The *Swiss Aviation Guide* is illustrated also with a number of fine photographs, while there is a map showing the aerodromes and indicating whether there are customs facilities and whether they are open for public or private use.

The *Danish Air Pilot* contains a similar map and information. It may be obtained from Det Kgl. Danske Aeronautiske Selskab, "Dagmarhus," 12, Vestre Boulevard, Copenhagen, V, price 2s. The *Swiss Aviation Guide* may be obtained on request from the Swiss Aero Club, Schanzenstrasse 1, Berne, which publishes it in collaboration with the Swiss National Tourist Office and the Swiss Touring Club.

Elmdon Airport

AIRCRAFT are to be prohibited from landing at Elmdon Airport, Birmingham, on the day of the King's Cup and Wakefield Trophy Air Races, September 2.

A *Notice to Airmen* will be issued by the Air Ministry closing the Airport from 9 a.m. until 12.30 p.m., and from 1.15 p.m. until 6.15 p.m. on this day. Visitors who wish to arrive by air must therefore land before 9 a.m. or between 12.30 and 1.15 p.m. in order to avoid interference with the races.

FROM the CLUBS and SCHOOLS

HANWORTH

CLUB and C.A.G. members logged over 235 hr. during the week ended August 18. Messrs. A. E. Dorey and W. H. Clisby have gone solo.

MARSHALLS'

A total of 148 hr. 15 min. was recorded during the week ended August 19.

REDHILL

A total of 207 hr. was recorded during the week ended August 19. Messrs. R. W. Guzzett, P. J. May and G. H. Patchett went solo.

WITNEY AND OXFORD

Flying time for the week ended August 19 totalled 82 hr. First solos were flown by Messrs. M. Horris, A. W. West and W. Johnson.

BEDFORD

Several cross-country flights were carried out by C.A.G. members during the week ended August 19. Mr. E. J. Field has joined the club as a new member.

PLYMOUTH

Adverse weather conditions prevented flying on three days of the week ended August 14; however, 78 hr. were flown. Mr. F. R. Stamp made his first solo flight.

ISLE OF WIGHT

Flying time for the week ended August 13 amounted to 62 hr. 20 min. Miss P. Poynder-Meares and Messrs. R. C. Battersby and A. J. Bridges went solo.

IPSWICH

Only on one day during the week ended August 14 was flying interrupted by rain and a total of 155 hr. was logged. Messrs. H. S. Fairhead, A. J. Crust and R. Jackson went solo.

INVERNESS

Twenty-one hours were flown during the week ended August 14; on five days no flying was possible. Messrs. A. L. Davidson, W. L. MacDonald and A. M. McLeod made their first solos.

DONCASTER

During the fortnight ended August 19, 160 hr. 30 min. flying time was recorded. Miss Wolerton and Messrs. Devenish, Wright, Lawton, Needham, Smith, Moore and Ogden carried out their first solo flights.

LINCOLNSHIRE

One hundred and fifty-three hours flying was recorded during the week ended August 18. Messrs. H. Frow, W. H. Chandler, A. O. Price, C. Cole, E. Cooper, G. E. Sappcote and B. F. Talbutt have gone solo.

WESTON

Rain and wind for the first half of the week ended August 14 restricted flying activity, but the total flown amounted to 128 hr. Messrs. G. Austen, S. R. Taylor, L. C. Richards and H. M. Hatcher made their first solo.

NORFOLK AND NORWICH

Favourable weather conditions allowed 122 hr. to be recorded during the week ended August 19. Seven members of the C.A.G. went solo. The second Moth Minor arrived at the end of the week and has been kept fully occupied.

CINQUE PORTS

In spite of several days of high wind, flying time for the week ended August 19 amounted to 85 hr. In the C.A.G. section Messrs. Staff, Arding and Parkin went solo. Visitors to the club included the Marquis of Kildare and Mr. Philip Avery.

THANET

In spite of nearly two days of rain the impressive total of 182 hr. was recorded during the week ended August 14. Miss Ralph, Miss Cochrane, Messrs. C. Hawes and G. Fletcher went solo.

SOUTH COAST

Over 122 hr. were flown during the week ended August 19. First solo flights were made by Miss V. P. Moyle, and Messrs. H. H. Poulton, H. G. Boxall and D. Clarke. The competition for the Bellairs Challenge Cup is being held on September 9.

EXETER

No flying was possible on three days of the week ended August 14, but 141 hr. were recorded. Messrs. F. R. Westcott and N. B. Webb went solo. A competition in the form of 30-minute solo reconnaissance flights is taking place over the next four weeks.

HORTON KIRBY

During the week ended August 18 226 hr. 25 min. were flown. First solo flights were made by Messrs. S. W. Slaughter, H. Harvey, S. S. Savage, J. Morse, A. C. Duncan, H. W. Hordan and I. C. Burke. Cross-country flights were made to Land's End, Ramsgate, Bristol, Hamble, Reading and Cardiff.

BROOKLANDS

Over 170 hr. flying was recorded during the week ended August 19. Cdr. E. E. Addis and Messrs. Berry, Hudson, Moody and Smart made their first solo flights. New members of the club are Messrs. Elsey and Biggs. A bombing competition was held on Sunday last, which was won by Mr. R. C. Reynolds.

HERTS AND ESSEX

Weather conditions were more settled during the fortnight ended August 17 and 248 hr. 15 min. were logged. First solo flights were made by Messrs. W. Inglis, S. J. Bate, G. L. Barratt, D. Bilham, A. W. Dukes, M. C. Arnold, A. V. Clark, J. C. Hildrow, R. A. King, J. W. Murcutt, H. I. V. Peters, E. J. Rawsthorne, L. C. Storey, G. P. Thompson and R. P. Wingfield. Six new members were enrolled during that period.

OVERSEAS

HYDERABAD

During the month of July a total of 61 hr. 40 min. was recorded. Capt. B. B. N. Wood was admitted to the club as a new member. Lt. G. Laverick completed his first solo.

BOMBAY

Flying time for the month of July was approximately 80 hr. The President and members of the committee gave a dinner at the Taj Mahal Hotel on July 27 to Mr. de Horthey, President of the Aero Association of Hungary.

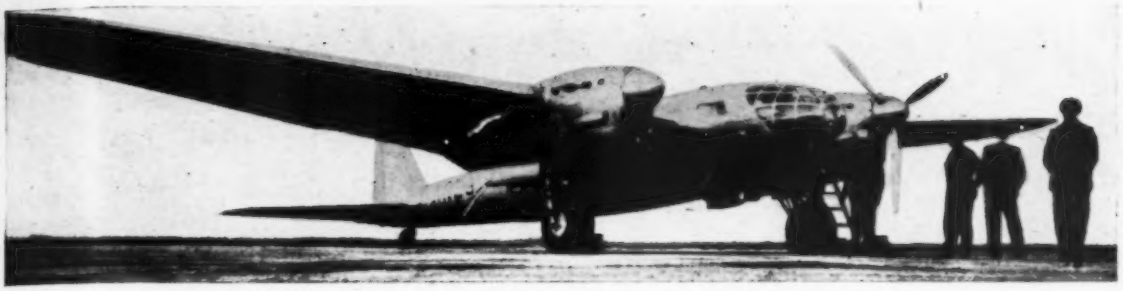
Forthcoming Events

SEPTEMBER.

Sat., 2nd. King's Cup Race and Wakefield Trophy Race.
Sun., 3rd. Gordon Bennett Balloon Race, Poland.
Sat., 9th-Mon., 11th. La Baule Rally.
Sat., 16th. Cinque Ports Flying Club: Wakefield Cup Race.
Sat., 23rd. Cardiff Aeroplane Club: London-Cardiff Race.

OCTOBER.

Sun., 1st. Aero Club de France: Coupe Deutsch de la Meurthe, Etampes.
Mon., 2nd-Sun., 17th. Milan Aero Show.



FAST AND FAR: The French Amiot 370 (two special Hispano Suiza 12Y engines) in which M. Rossé, on an unsuccessful attempt to break the world's speed record for 10,000 km. and the record for distance in a closed circuit (now held by Japan), averaged more than 186 m.p.h. for 3,728 miles. The Japanese record is 115.5 m.p.h. for about 6,876 miles. The Amiot took off at a weight of 22,217. It is generally similar to a type of bomber now in production for l'Armée de l'Air.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE IMPERIAL DILEMMA

Ourselves and America

I HAVE read with much interest your comments relating to the latest predicament in which Imperial Airways find themselves. An important aspect, as you suggest, is: "Should mails and passengers be separated, or carried in one aeroplane?"

Surely, this must depend on the capacity of the particular machine in question. As far as the "C" class boats are concerned, it is perfectly clear that a payload of 7,000lb. is insufficient for the carriage of both mails and passengers.

With their enormously increased payload, the new "G" class boats could completely overcome the present crisis. In fact, ten of these machines could do the work of 28 "C" class boats and have a 33 per cent increased range, as will be seen from the figures given below.

	Short "G"	Short "C"
Payload:	19,500lb.	7,000lb.
Range:	1,000 miles.	755 miles.
Speed:	209 m.p.h.	199 m.p.h.

By removing the inboard long-range tanks from the "G" boats, mails could be accommodated in the wings, the upper aft part of the hull and possibly one compartment in the lower deck. The enormous capacity of the hull would permit of at least 30 passengers being accommodated in addition.

A little simple arithmetic can best answer the question of mails and passengers, should they be separated?

Payload 1,000 miles (mail only)	24,000lb.
Payload 1,000 miles—4,500lb. (furnishings)	19,500lb.
Payload 1,000 miles 30 passengers @ 200lb. ..	6,000lb.
Payload 1,000 miles (mail)	13,500lb.

Without doubt, the *Golden Hind* represents the "Empire Boat" par excellence. Operating costs cut down to half, difficulties relating to trained personnel removed, time-tables speeded up and adequate range for all emergencies. To use these boats for the long ocean crossings is "to waste their sweetness o'er the watery deep."

The Consolidated Company in an advertisement, announce: "To London in luxury *non-stop*." This phrase does not refer to their new boat either, but the Model 29, a four-engined machine. In a few short months, the newly formed American Export Airlines will inaugurate an overnight passenger and mail service, using these boats, that will make Pan American Airways sit up and take notice.

The Boeing Company are well ahead with the construction of a six-engined monster with a 250-feet span, which, I understand, is to be challenged with a four-engined version of that phenomenal 300 m.p.h. Consolidated 31.

To meet this challenge, we have only land machines; although one of these has a speed of 331 m.p.h. [Surely not so high? ED.] the position is desperate. Money must be spent like water if we are to get a look in. It is not fair to expect one flying boat constructor to compete with at least four in America

The barest minimum requirements for three years hence in a boat can only be met by giving all four of our flying-boat constructors a look in. Possible specification would be as follows:—

Wing span	200 ft.
Length	135 ft.
Weight	150,000 lb.
Speed	300 m.p.h.
Engines (horiz. oppos. 16-cyl.)	12,000 b.h.p.

Engines: Bore, 6¼in.; stroke, 6¾in.; volume, 54.3 litres.

A petrol consumption of 0.39 lb./b.h.p./hr. ought to be possible with these engines, which would be buried in the wing and water cooled.

SIMPLE JOHN.

London, N.W.3.

IN MEMORY OF "K. K."

His Hobby as an Inspiration to Cadets

THE committee of No. 99 (Folkestone) Squadron, Air Defence Cadet Corps, are encouraged by the response to the proposal to establish a memorial to the late K. K. Brown, with the approval of Mrs. Brown.

Through the generous assistance of Miss Campbell, of Auchmannock, "K. K.'s" complete workshop and equipment has been acquired to form the nucleus of a workshop (engineering) to be established at No. 99's H.Q., and to be known as "The K. K. Brown Memorial Workshop."

Suitably placed therein will be a record of "K. K.'s" services to aviation, together with photographs (kindly given by Mrs. K. K. Brown) and other mementoes, and further gifts are required for the complete equipment of the memorial.

It is felt that this practical method of keeping in memory one who was so highly esteemed among his fellows will be a constant source of inspiration to the Youth with whom it is our privilege to be associated in the cause of our country.

For this purpose, therefore, we invite donations and gifts of suitable equipment to enable this object to be achieved at an early date. It is hoped, when the scheme is completed, to have the opening ceremony undertaken by our Patron, Lord Willingdon. Donations or gifts may be sent to this office and they will be gratefully acknowledged.

12, Cheriton Place, Folkestone. T. STUART LEWIS,
Chairman, No. 99 (Folkestone) Squadron A.D.C.C.

THE RESERVE FLEET

Not to be Confused with the R.N.R.

I AM very sorry to see that in last week's issue, in the inscription under the illustration on page 149, you state "His Majesty inspects the R.N.R."

This is utterly absurd. His Majesty inspected the *Reserve Fleet*, which is quite a different thing and which was manned for the most part by Royal Fleet Reservists or pensioners.

Royal Fleet Reservists are men who have served their time in the Royal Navy and who have since passed into civil life, but who are liable for recall in an emergency or, as in this case, for a test or partial mobilisation. The *Reserve Fleet* consists of older vessels of the fleet which are "not in the first line nor the first flush of youth" and which, in normal times, are reduced to small or skeleton crews.

The *Royal Naval Reserve* (R.N.R.) consists of officers and men of the Merchant Navy who perform periodical training during leave periods, etc., in His Majesty's ships or shore establishments and who, in the event of war would, in most cases, become full-time members of His Majesty's Navy. They are usually the last of reserve forces to be called up because it is not desirable to denude the Merchant Navy of personnel unless the crisis is acute.

I hope that you can find space to correct what is, unfortunately, a too-common error. E. C. TALBOT-BOOTH,
Lieut-Commander, R.N.R.

SERVICE AVIATION

Royal Air Force and Official Announcements: Fleet Air Arm News: Military Aviation Abroad

WHERE THE BAFFINS WENT: A considerable number of ex-R.A.F. Blackburn Baffin torpedo-bombers are being used by the Royal New Zealand Air Force. Those above are flying over mountains in the Wellington Province.

Our French Visitors

ABOUT two hundred French bomber, fighter, and reconnaissance aircraft were used in a series of training flights over England last week. Three "raids"—during the night, in the morning and in the afternoon—were made, the main objectives being London, Liverpool, Bristol, Birmingham, Manchester and Oxford.

According to a French communiqué the flights were organised to perfect co-operation between the British and French Air Forces. The French machines were engaged by R.A.F. fighters and by anti-aircraft and searchlight units and afforded practice for the Observer Corps. The aircraft included Potez 63s, Amiot 143s, Marcel Bloch 131s, and Lioré 45s.

A feature of the Exercise was the way in which scouting machines, in touch by wireless with the bombers, advised the raiders of the best method in which to approach and attack their targets.

A Sassoon Bequest

AMONG the bequests in the will of Sir Philip Sassoon was the following: £5,000 to the Treasury Solicitor, the income to be applied at each half-yearly passing out of cadets from the R.A.F. Cadet College at Cranwell in a prize for the Cadet, who, in the opinion of the Commandant of the College, shall be the best all-round, excepting the winner of the Sword of Honour.

R.A.F.V.R. Expansion

A NUMBER of R.A.F.V.R. centres are now approaching the establishment set them in the current expansion scheme. The distinction of first reaching full establishment in all sections has fallen to the Brighton and Derby centres, though the question of raising the current establishment of centres is constantly under review. In several of the larger towns the number of applications for the air section in hand are sufficient to fill all immediate vacancies. London, Glasgow, Manchester, Birmingham, Nottingham, Southampton, Reading and Coventry are the principal towns concerned. Current establishments will be reached in these towns as soon as candidates have been selected, medically examined and attested and additional training facilities have been provided.

Blenheims for Singapore

A CONSIDERABLE number of Bristol Blenheim bombers have been flown from India to Singapore to strengthen the R.A.F.'s Far Eastern defence force. Some thousands of troops have also been drafted.

R.A.F. Sport

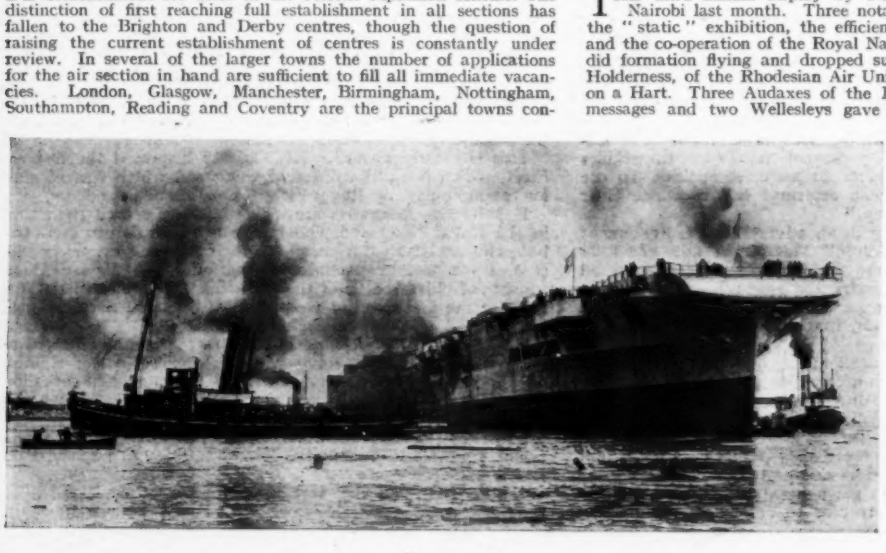
FROM August 24-29 the R.A.F. Swimming Championships will be held at Halton and from 28 to 30, the Autumn Golf Meeting will take place at the Berkeley Golf Club, Ascot.

Aircraft Depot, India, Reunion

IT is proposed to hold an all-ranks reunion dinner in London, at an early date in December, for personnel who were at the Aircraft Depot, India. Tickets will be priced 5s. 6d., and all interested are requested to communicate with F. G. W. Hoile, c/o "Westgarth," 16, Oak Tree Road, Tilehurst, Reading, before September 30. A special invitation is given to all ex-members of the one-time R.A.F. Old Boys' Association and to the present Karachi (India) Branch Comrades of the Royal Air Forces Association.

A Rhodesian Display

THE third annual display by No. 223 Squadron was given in Nairobi last month. Three notable features were the scope of the "static" exhibition, the efficiency of the Rhodesian Air Unit and the co-operation of the Royal Navy. A flight of five Wellesleys did formation flying and dropped supply parachutes, and Flt. Lt. Holderness, of the Rhodesian Air Unit, gave a display of aerobatics on a Hart. Three Audaxes of the Rhodesian Air Unit picked up messages and two Wellesleys gave a demonstration of slow and high-speed flying. It was at this stage that a diving Wellesley crashed, killing Flt. Lt. F. C. Camp and Corpl. J. C. Snaith. There was a fly-past by Wellesleys, Harts, Audaxes, Walruses of the Fleet Air Arm and a Valentia bomber transport. The set piece was an attack on an oil refinery. Particularly enlightening was the agility of the F.A.A. Walruses which "manœuvred like polo ponies."



H.M.S. *FORMIDABLE*: is our latest aircraft carrier to take the water. Her launch was attended by a mishap, the ship launching herself prematurely. In essentials she resembles H.M.S. *Ark Royal*.

SERVICE AVIATION (CONTINUED)

TROOP TRANSPORT TRIAL: Several bomber transports were recently used to carry troops from Bembridge, I. O. W., to Yatesbury. A contingent is seen deplaning from a Bombay.

Indian Re-equipment

THE re-equipment of R.A.F. squadrons in India which started in May with the supply of Blenheims to a bomber squadron is proceeding steadily. A second squadron has now been re-equipped with Blenheims, the first two flights being flown out to Karachi from England and the third flight being assembled at the Karachi depot.

The Cosford Magazine

THE new school at Cosford (Staffordshire) for aircraft apprentices has just begun publication of a school magazine. The first issue, dated Midsummer 1939, starts with a foreword by the commanding officer, Group Capt. W. J. Y. Guilfoyle, O.B.E., M.C., and a photograph of him appears as the frontispiece. The letterpress in the issue is full of "go" and the production is most attractive. Some excellent essays and short stories by aircraft apprentices prove that minds are very wide awake at Cosford.

Flying Accidents

THE Air Ministry regrets to announce the following flying accidents:—

A/C.1 Ivor Roberts died on August 13 as the result of injuries received in the aircraft accident which occured at Carlton, near Bedford, on August 11, 1939.

Cpl. John Pridhoe lost his life as the result of a collision in the air which occurred near Berwick-on-Tweed between two aircraft from No. 2 Air Observer School on August 17. Acting Flt. Lt. James Mail Bodman, who was uninjured, was the pilot of one aircraft and Cpl. Pridhoe the only other occupant. P/O. Patrick Chaloner Lindsay, the pilot of the second aircraft, was slightly injured and the other occupants, A/C.1 William Fletcher and A/C.1 Alexander Armour, were uninjured.

P/O. Reginald Raymond Harper lost his life in an accident which occurred in Yorkshire, on August 18, to an aircraft of No. 185 Squadron. P/O. Harper was the pilot and sole occupant of the aircraft.

Royal Air Force Gazette

Air Ministry, August 8

Royal Air Force

General Duties Branch

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated—E. L. Frith, B. F. Pyne (June 27); G. O. Arscott, H. C. Baker, R. B. Barr, D. E. Bond, J. G. Bowie, W. H. Corbet, W. P. Crosse, K. Davies, C. H. Elliott, A. E. Evans, H. J. Field, R. H. B. Field, S. A. P. Fischer, D. I. Fletcher, D. Forward, P. de G. Fry, G. P. Gouge, J. C. Graham, J. D. Hall, R. H. Harper, H. C. Hilton, S. R. Hinks, W. Hughes, J. N. Hunt, P. C. Joel, T. M. Kaze, G. M. Kelly, W. J. Lewis, J. Loat, J. W. Louw, P. F. Maclaren, K. E. Macrostie, J. J. Meikle, L. D. P. Murphy, J. Musgrave, H. E. Mussenden, R. M. Over, A. B. J. Pearson, R. D. Perkins, C. W. A. H. Rafter, J. B. Ramsay, D. Redmayne, F. H. Ridley, G. L. Ritcher, C. G. Robertson, H. L. Rust, C. W. R. Sawyer, F. W. Smith, J. N. Stacey, R. R. Stephenson, D. A. Stewart, D. R. Strachan, H. F. Truscott, P. J. Valachos, R. E. B. White, D. C. Williams (July 25).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—L. W. Skey (Acting Flight Lieutenant) (May 16); J. R. Brown (June 16); S. W. Baldie (June 21); F. O'Driscoll (July 3); R. J. Manton, F. S. Powley (July 4); W. P. Bain, H. D. H. Cooper, L. H. McFarlane, B. W. Currie, G. D. Clancy, D. A. Strachan, C. S. P. Russell (July 21).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—R. B. Carr (May 11); T. W. C. Fazan, C. D. S. Smith, M. P. Casano, W. J. L. Stevenson, J. W. B. Vernon (June 1); T. H. Rebbeck (June 28); H. G. Marriott, S. R. Gibbs, W. C. Williams, K. H. Savage, P. D. J. Strong (July 1); W. Kinane (July 3); J. C. Archer, (July 7); L. F. Gregory (July 8); P. H. M. S. Hunt (July 10); F. M. C. Corelli, D. E. Bennett (July 12); J. C. Halley (July 14); B. R. Kerridge, M. W. B. Knight (July 17); C. G. C. Olive (July 24); G. H. F. Plinston, G. G. Storey (July 31).

P/O. D. F. J. Willis (since promoted) is granted the acting rank of Flight Lieutenant (May 11).

The following Flying Officers relinquish the acting rank of Flight Lieutenant on the dates stated:—R. Williams (June 26); F. C. Stibbard (June 28); J. D. Harris (June 29); P. H. Rebbeck (July 22); E. A. Whiteley (July 30); J. W. S. Forbes (August 1); G. Thomas (August 6).

The following Pilot Officers relinquish the acting rank of Flight Lieutenant on the dates stated:—G. W. Slee (April 17); P. F. Murch (July 19). Reduction takes effect from July 17.

A.V-M. J. E. A. Baldwin, C.B., D.S.O., O.B.E., is placed on the retired list at his own request (August 15); Flt. Lt. R. H. W. Empson is placed on the retired list at his own request (August 15); Flt. Lt. I. W. Braye is transferred to the Reserve, Class A (August 12); the short-service commission of Acting Pilot Officer on probation W. J. Jarvis is terminated on cessation of duty (August 11).

Equipment Branch

Acting Pilot Officer on probation W. P. Sansom is graded as Pilot Officer on probation (March 27).

Accountant Branch

F/O. W. E. Wolsey is granted the acting rank of Flight Lieutenant (June 12).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

J. K. Flower is granted a commission as Flying Officer in Class A with effect from August 4 and with seniority of March 16, 1932; M. J. du Cray is granted a commission as Flight Lieutenant in Class C with effect from August 1 and with seniority of June 18, 1936; Lt. E. J. E. Warden (R.M., Ret.) is granted a commission in Class CC as Flying Officer (July 3).

The following Flight Lieutenants are promoted to the rank of Squadron Leader (June 30); W. R. S. Humphreys, A.F.C., G. A. Simons, I. W. C. Mackenzie, R. E. Hall, C. C. Clark, L. C. Barling, J. F. Moir, J. W. Thomson, R. C. Whitle, J. B. Stockbridge, J. B. Veal, D. Dickson, E. J. H. F. Moreton, C. A. Goatcher.

Flt. Lt. W. H. Brett relinquishes his commission on cessation of duty (July 16); F/O. D. G. W. Somerville relinquishes his commission on completion of service (July 20).

Equipment Branch

Flt. Lt. J. T. Vernon is promoted to the rank of Squadron Leader (June 30).

Medical Branch

J. B. Murphy, M.B., B.Ch., is granted a commission as Flight Lieutenant in Class D, with effect from August 1, and seniority of August 1, 1932.

Service Aviation

Royal Air Force Volunteer Reserve

General Duties Branch

T. H. Clarke is granted a commission as Flying Officer with effect from August 1, and with seniority of February 17, 1937.

The following are appointed Honorary Flight Lieutenants (June 26):—Maj. W. E. Guinness; Brig. H. St. G. S. Scott, C.B., D.S.O. (I.A., Ret).

Administrative and Special Duties Branch

The following are granted commissions as Pilot Officers on probation, with the honorary ranks stated (August 8):—*Squadron Leader.*—D. R. McWhinnie. *Flight Lieutenants.*—H. E. Bracey; W. E. N. Clark; C. McC. Officer; R. E. G. Wendt. *Flying Officer.*—T. J. Carswell.

The following are granted commissions as Pilot Officers on probation (August 8):—H. B. T. Childs; I. M. Horobin; H. B. Jenkins; S. S. Kirsten; F. C. Rowe.

Equipment Branch

Acting P/O. M. D. Crichton is employed with the Royal Air Force (June 23); Acting P/O. T. H. Snelling ceases to be employed with the Royal Air Force (July 23).

Meteorological Branch

The following are granted commissions as Pilot Officers on probation (August 8):—A. F. E. Cotton, P. J. H. Green, G. W. Hall, K. A. Hirst, J. C. Lawrence, L. R. Morey.

Auxiliary Air Force

General Duties Branch

No. 500 (County of Kent) Squadron.—H. P. Taylor is granted a commission as Acting Pilot Officer (July 28).

No. 607 (County of Durham) Squadron.—P/O. M. H. B. Thompson is promoted to the rank of Flying Officer (April 20).

No. 613 (City of Manchester) Squadron.—F. Pilling is granted a commission as Acting Pilot Officer (August 1).

No. 614 (County of Glamorgan) Squadron.—W. G. Williams is granted a commission as Acting Pilot Officer (June 14).

No. 901 (County of London) Squadron.—Flt. Lt. W. C. Titheradge is promoted to the rank of Squadron Leader (June 6).

No. 902 (County of London) Squadron.—Flt. Lt. J. G. Hudson is promoted to the rank of Squadron Leader (June 6).

No. 903 (County of London) Squadron.—Flt. Lt. R. G. Frith is promoted to the rank of Squadron Leader (June 6).

No. 904 (County of Surrey) Squadron.—Flt. Lt. W. E. B. Barclay, M.C., is promoted to the rank of Squadron Leader (June 6).

No. 905 (County of Surrey) Squadron.—Flt. Lt. M. G. Begg, M.C., is promoted to the rank of Squadron Leader (June 6).

No. 906 (County of Middlesex) Squadron.—The following are promoted to the ranks and on the dates stated:—*Squadron Leader.*—Flt. Lt. K. A. H. Hassell, M.C. (June 6). *Flying Officer.*—Acting P/O. C.-L. L. A. de Beaumont (July 20).

No. 907 (County of Middlesex) Squadron.—Flt. Lt. H. E. Hills is promoted to the rank of Squadron Leader (June 6).

No. 908 (County of Essex) Squadron.—The following are promoted to the ranks and on the dates stated:—*Squadron Leader.*—Flt. Lt. J. E. D. Benham (June 6). *Flying Officer.*—Acting P/O. V. G. E. Gardner (July 13).

No. 909 (County of Essex) Squadron.—H. D. Thomson is granted a commission as Pilot Officer (August 1); Flt. Lt. A. H. E. Dew is promoted to the rank of Squadron Leader (June 6).

No. 910 (County of Essex) Squadron.—The following are promoted to the ranks and on the dates stated:—*Squadron Leader.*—Flt. Lt. P. H. Tanner, M.B.E., M.C., T.D. (June 6). *Flight Lieutenant.*—F/O. W. H. Stangroom (July 14).

No. 917 (County of Warwick) Squadron.—The following are granted commissions as Flying Officers on the dates stated:—N. Edyvean-Walker (June 15); A. E. Limehouse (July 12).

No. 946 (City of Glasgow) Squadron.—F. D. C. Taylor is granted a commission as Pilot Officer (July 17).

Equipment Branch

No. 903 (County of London) Squadron.—W. J. Amlot is granted a commission as Pilot Officer (August 2).

Medical Branch

No. 921 (West Lancashire) Squadron.—J. E. G. McGibbon, M.B., B.S., D.L.O., is granted a commission as Flight Lieutenant (July 3).

No. 935 (County of Glamorgan) Squadron.—E. Llewellyn, M.B., Ch.B., is granted a commission as Flying Officer (August 2).

FOREIGN SERVICE NEWS

A.A. Guns and Sound Locators

AN Italian writer claims that experience in the Spanish War has shown that an average of 15 shots suffices to bring down aircraft flying at 13,000 ft. Errors in sound-locators are, he maintains, mainly due to insufficient training of the operators. In these instruments it does not pay to increase the base much beyond three yards. The range can be increased by electrical amplification. Blind persons are being extensively enrolled in Italy to operate sound locators as their hearing is exceptionally acute.

Incendiary Bombs

A LARGE bomber, according to a German authority, can carry over 2,000 small incendiary bombs. These are dropped from special containers in batches of ten or twenty. Due to the light weight and the shape of these bombs the terminal velocity is low (260ft./sec.) and the dispersion wide. The nose of the bombs is flat and stability is assured by a terminal rod 8 centimetres long. The charge consists of thermite which will burn for 40-50 seconds (without oxygen) and the heat liberated melts the Elektron case, which burns for 10-20 minutes. The pressure generated by the burning thermite may project portions of the molten casing for a distance of 18ft.

It is considered that a bomber flying at 1,850ft. and discharging 20 bombs every second on a 15 per cent. built-up area will start a fire on every section of 24-30 sq. yards unless suitable measures are taken such as fitting 6 mm. steel plates, a single layer of sandbags (well compressed) or a layer of reinforced concrete 10 cm. thick.

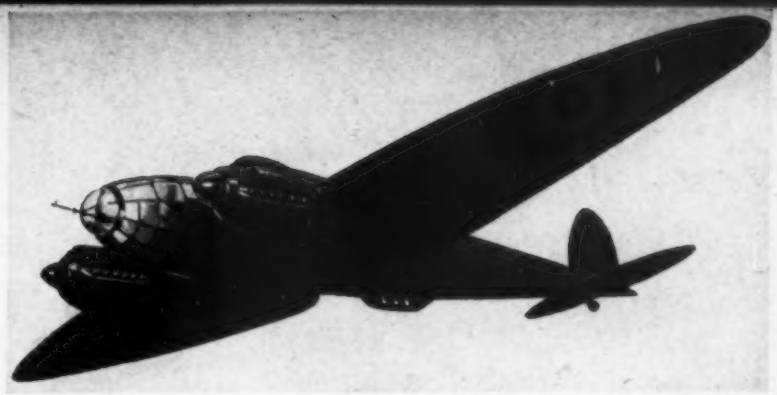
The Breda 88

AMONG the most powerful of the twin-engined multi-purpose monoplanes now in service with the air forces of the Powers is the Italian Breda 88, which can be used for strategical reconnaissance, high-speed bombing or fighting. Unlike the majority of Italian bombers it is of all-metal construction and represents one of the most interesting attempts in this field made by Italy. Some time ago a prototype aircraft averaged about 344 m.p.h. over a distance of 62 miles, carrying a load of 2,200 lb.; the average over 621 miles with the same load was about 325 m.p.h.

The machine is arranged as a high-wing monoplane. The pilot sits forward of the leading edge and is armed, in the case of the standard Italian machines, with large-bore machine guns; the rear section of the fuselage houses the rear gunner and the main fuel tanks. Fuselage construction is of chrome molybdenum steel tubing, covered with metal panels with flush riveting. Chrome molybdenum steel, incidentally, is also used in the wing, which has duralumin spars. Handley Page slots and slotted flaps are standard. Two Piaggio XI RC engines are fitted, being installed in nacelles below the wing.

Data for the Breda 88 are as follows:—Disposable load, 4,850 lb.; cruising range with 2,204 lb. load, 1,118 miles; minimum speed, 69 m.p.h.; take-off run, 470yd.; landing run, 490yd.; climb to 16,400ft., 11 min.; ceiling, 27,900ft.

CAUSE AND EFFECT: The upper view must be almost unique in that it was taken from the rear cockpit of a dive-bomber, actually a German Junkers Ju.87, during a vertical dive. The lower view purports to show the explosion of a bomb, probably of 500 kg., dropped from the Ju.87.



Modified version of Heinkel He 111K bomber (Germany).

AIRCRAFT of the AXIS POWERS

Recognition Drawings of More Current Types

IN the issue of *Flight* dated July 20 a series of recognition drawings of German and Italian aircraft was published. On this page half a dozen more service types are shown to the same scale. The revised version of the Heinkel bomber (top) is generally similar to the type already illustrated, but has a modified nose and lower gun position.

The Fiat C.R. 42 single-seater fighter is likewise a development of the C.R. 32 shown in the first set.

Of particular interest is the new Savoia Marchetti S.M. 85 single-seater twin-engined dive-bomber, which has special flaps to reduce its diving speed.

(Right) Cant Z.501 reconnaissance flying-boat (Italy).

Fiat C.R.42 single-seater fighter (Italy).

(Left) Fiat B.R. 20 bomber (Italy).

(Lower left) Piaggo P-32 bomber (Italy).

(Below) Savoia Marchetti S.M. 85 dive-bomber (Italy).

A notable photograph—necessarily rather hazy by reason of the high telescopic magnification—showing H.E. shells bursting near a Queen Bee operating from the range visited by the author.

WITH A QUEEN BEE FLIGHT

The Technique of Operating Pilotless, Radio-controlled Aircraft for Gunnery Targets : Territorials' Good Marksmanship

By MILES HENSLOW

MUCH has been written in the lay Press about Queen Bees, and as a result it is quite well known by the general public that these strange craft have been in use by the R.A.F. for a number of years. So well has their secret been guarded, however, that apart from the name little more is known about them to-day than when the first experimental machine was created, more than twenty years ago.

During this time, however, pilotless radio-controlled aircraft have been developed from an almost fantastic idea into something so practical and simple that those who work with them regard them as nothing more extraordinary than an efficient piece of machinery. The experimental stage was passed many years ago; whatever plans the Air Ministry conceived for them have been duly tested and approved; and to-day the Queen Bee type is in regular, almost daily, use as a target for anti-aircraft guns.

It is impossible, none the less, to write of these radio-controlled aeroplanes in the same light as they are regarded by that branch of the Royal Air Force whose job it is to operate them; to the privileged onlooker they must appear as one of the most amazing inventions of recent years; and the casual efficiency with which they are operated only serves to increase the wonder.

As *Flight* readers know, the Queen Bee is a definite aircraft type. To all outward appearances it is a Tiger Moth on floats, but it differs from that well-known type in that it is of wooden construction. The De Havilland Company has been making them under contract for a number of years, not in ones and twos, but in dozens; and a special branch of the Hatfield factory is constantly busy with repairs—a tribute to Territorial gunfire.

The front cockpit of the Queen Bee is almost the same as that of any other D.H. two-seater, and when the machines leave the factory they are fitted out with their radio apparatus and controls by a special department of the Air Ministry; similarly, before re-entering the factory for repair or overhaul, all traces of radio apparatus are removed.

After being tested and passed as serviceable at one or other of the Air Force stations, the Bees are fitted with floats and delivered, as required, to the various Queen Bee flights, either at coastal stations or attached to the Fleet Air Arm. There are a number of these special flights in existence, and they are known by letters of the alphabet; "X Flight," for instance, is stationed in Norfolk, adjacent to a military training camp.

The equipment used for operating the radio-controlled Bees is modern, efficient and compact; but for the launching catapult it is very mobile. A canvas hangar houses the aircraft, two or three vans accommodate the generating equipment and radio apparatus, and the aerials and master controls are easily moved; indeed, the master control box is considerably smaller and lighter than an automatic ticket machine.

Before being put into service as A.A. targets, all Bees are carefully tested once more; floats are removed, wheels fitted, and an R.A.F. pilot makes the take-off from the front cockpit. As soon as the Bee is in the air, the pilot "hands over" to the man on the ground below, and is flown about the countryside, dived, climbed and banked according to which buttons on the control box are pressed; even navigation lights can be switched on and off. This, as a pilot who has made many such test flights assures me, is a most uncanny job at first.

When it has been proved that all the controls are answering precisely to the distant radio signals, the Bee is landed, put back on its floats and stored in the hangar until it is needed.

For purposes of good co-operation between the ground

"pilot" and the gunnery officers, the master control box is usually located a short distance away from the guns and connected to the radio transmitter by land line—which may be of any reasonable length.

As the Bees are required by the gunners, they are brought to the catapult on temporary wheels fitted to the float undercarriage and hoisted into position on the cradle by crane; the catapult itself moves on a turntable and can be adjusted to point into wind.

The launch is the most dramatic sight that anyone could wish to see. Started by crank, the Bee's Gipsy engine is run up in the normal way and the flying controls are given a final check. Then, with everyone standing clear, a signal is given to the man at the control box. Mysteriously, rudder, elevators, etc., move about as buttons are pressed, maybe a quarter of a mile distant. Suddenly the engine roars at full throttle, there is a hiss of compressed air, and the Bee drones away over the sea, climbing steadily as flying speed is maintained.

Inevitably one turns to the thin aerial wires swinging overhead, and wonders . . .

The working range of the Queen Bee, like the actual working parts, may not be discussed here; but suffice it to say that it can be manœuvred successfully as long as it is within range of powerful binoculars; and, incidentally, from the point of view of its usefulness as a target, it is most essential to keep the Bee in sight from the moment of launching until the final landing.

Long Endurance

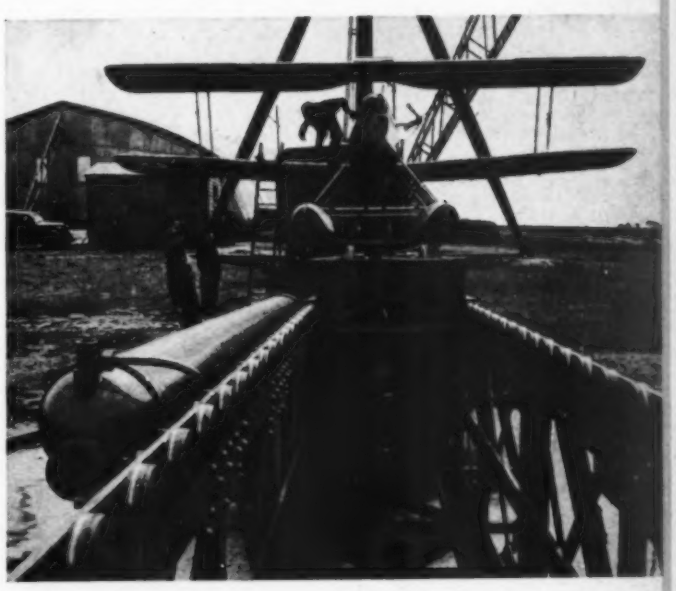
Since it is quite usual to keep the machine in the air for two and a half to three hours at a time, and since the gunnery officers like it at an altitude of at least 6,000ft., it will be seen that the "pilot's" task, even though he is comfortably placed in a deck chair, is a very exacting one. Actually, it is customary for two officers to watch the Bee, so that there is no danger of losing it while giving the eyes a rest.

An airman stands by the master control box, log book and pencil in hand, and as the officer calls out the various orders ("Climb—Left Turn—Level," etc.) he repeats them before pressing the appropriate buttons and entering them in the book. At the distant transmitter, electrical recording apparatus is fitted, which also records all signals sent to the Bee, and these are compared with the log book after each flight.

As soon as the Bee is launched it is flown in easy stages, turning and climbing, until the necessary height is reached; and since Air Ministry regulations stipulate that no radio-controlled aircraft may be flown over land unless there is a pilot on board, all this manœuvring takes place over the stretch of sea parallel with the shore.

Sometimes, when the Bee flies into a particularly dense patch of cloud, it is necessary to put it into a glide until it reappears; for although its rate of climb and turn are known, and can be timed by stop-watch, as a mere speck at several thousand feet it is quite easy to lose.

When at the correct height the target is flown up and down the coast and the gunners get to work on it. But since modern gunnery is so accurate, it is not customary to loose-off high explosive at the target while it is on a steady course; instead, "burst-short" is used, and observers on the ground, aided by electrically operated



(Above) One of the guns with, in the foreground, the now well-known predictor. (Below) A Queen Bee on the catapult ready for launching. (Lower picture) With one wing down, but speedily to be corrected by the radio control, the Queen Bee leaves the catapult

(Above) A gunner operating the stop-watch recording system which helps to ensure accuracy in shooting. (Right) Spotters in action with an identification periscope—the man with the megaphone is passing on information to the predictor crew.

ciné-cameras and theodolites, calculate hits and misses by time and angles.

H.E. shells are used after a reasonable amount of "burst-short" practice has been put in; in other words, having destroyed the Bee in theory the gunners are allowed to try to do it properly.

It is then that the real fun begins. There is something about shooting at a real target that seems to inspire the gunners; and the R.A.F., although they have no objection to their Bees being shot down, are out to keep them in the air as long as possible.

"Jinking"

To avoid unnecessary waste the gunnery officer calls for an erratic course, and instead of flying the target steadily to and fro, orders are given to "jink" it; and since the guns are but a few yards away from the master control box of the Bee, the R.A.F. officer has the advantage of being able to hear the order to fire, make full use of the few seconds that follow, and do all that he can to beat predictors and range-finders—all of which makes for very excellent training.

When it is realised that an H.E. burst within a hundred feet or so of a solitary aircraft can well be regarded as fatal to one or more aircraft in that area—and that the solitary Bee very rarely lands without shell splinters in floats, fuselage or controls—some idea of the accuracy of Territorial gunfire (usually only by trainees) can be guessed; and such results prove eloquently the real value of a radio-controlled target from more than one point of view.

A direct hit is by no means unknown, and a burst sufficiently near to the machines to bring it down completely out of control is quite common. Nearly every Bee in service bears evidence of damage—patched floats, new planes and control surfaces.

Attached to each Queen Bee flight is a crash or salvage launch and one or more speed-boats. This launch is fitted with short-wave radio-telephony, and is in constant touch with the shore station during operations. Lying just out of range of falling splinters, she is ready to speed away to the rescue of the Bee in distress within a second or so of a hit being recorded; meantime, the speed-boat races out across the sea so as to keep the Bee afloat until help arrives.

Not many Bees are lost, though after a serious wound few are worth repairing; nevertheless, the wreckage is lifted aboard the salvage launch by crane, landed some distance down the coast, and brought back to the station by road for a thorough inspection.

No better proof of efficiency, both in design and handling, is needed than an observation of a landing at sea—often a forced landing—brought about with the aid of binoculars and buttons. Indeed, it is nothing short of amazing to see the way in which an apparently helpless Bee can be put safely down.

And, to use a popular expression, "they can take it." I watched one, some four or five miles out at sea, make a perfect cross-wind landing in a wind of about twenty-five miles an hour!

It is one thing to equip a large battleship with radio control, to make it a safe and realistic target for heavy gunfire, but it is quite another proposition to obtain the same efficiency in a light aeroplane. In a battleship—even a small launch—weight does not matter; the control system can incorporate heavy electrical systems, power plants and gyroscopes weighing many tons.

But remember, in the Queen Bee both weight and space are at a premium; and into the very small space of one cockpit and locker is fitted everything—radio receiver, power plant and controls.

Twenty years is a long time, but the men who have designed and developed the radio-controlled target aircraft have made full use of that time. Furthermore, the experiments of those twenty years cannot be imitated in a matter of weeks. Not only is Great Britain many years in advance of every other country in this sphere, but she is also likely to remain ahead.

(Below, left) H. E. rounds laid out in preparation, with fuses marked against them. (Centre) An elaborate range finder, data from which is passed on to the predictor crew. (Right) Setting the fuse on a shell.

RAIDING by CELESTIAL NAVIGATION

Part II : Navigational Teamwork and the Initial Corrections for Wind

By FRANCIS CHICHESTER

THIS, the second of a series of special articles by an acknowledged authority on navigation, continues the detailed account of an imaginary bombing raid carried out from a base in England by means of celestial navigation. Mr. Chichester seeks to prove his contention that a formation of bombers can be navigated on a raid of a thousand miles, above cloud the whole time, yet knowing its position to within less than one mile.

His imaginary formation consists of a specially equipped navigational machine leading two heavily laden bombers. Their target is a stronghold where, it is known, the enemy will have its entire high command gathered in conference at a certain hour.

Last week the preliminary preparations and the take-off were described. Thirty-six minutes after starting the port and starboard machines took up formation on the leader. They passed over Rame Head, flying seaward, at 22.47 G.M.T.

TO sum up procedure before getting down to detailed methods, let it be assumed that the bombers have reached the height at which they propose to fly. The first navigation task is to fix the position by star observation. This fix shows how much they have been put off course during the climb since they left the ground. With this information they estimate what the position will be a few minutes later at the exact half hour; also what the wind is at that height. They allow for this wind and fly on for half an hour, when they obtain another fix by star observation. The amount they find themselves off course then tells them by how much they have misjudged the wind, or, alternatively, how much it has changed. Wrapped up with the windage are the pilotage error and any instrumental errors, but these are not likely to amount to much; in any case, they will not affect the accuracy of the navigation, since they are included in the correction.

The team work used by the eight navigators to obtain 48 sights of a star in two minutes is described. The altitude and azimuth of the two chosen stars were precomputed a few minutes before required. As the actual observations could not be made at the exact instant of the computation, one of the computed altitudes had to be adjusted to the time of the observation; the other required no adjustment, because the star was so nearly abeam that for a short interval the aeroplanes could be considered to be running along the position line. This shows the great advantage of choosing one star abeam. And in this respect star curves fail; they give only three stars to choose from and a navigator would be exceptionally lucky if one of them were abeam—luckier still if it were nearly abeam throughout the whole flight, as was the star chosen for this flight.

For one observation the good old cosine formula was used—and a mistake was made, as so frequently happens when using tables in an aeroplane. The mistake was discovered when the work was checked by the Bygrave Slide Rule. For the second observation the Hughes-Comrie tables were used and the result again checked by Bygrave.

Computing the altitudes in the air and adjusting them to the moment of observation could both have been avoided by work done on the ground before the flight, in the form of preparing curves of altitude and azimuth of the two stars for various points along the route. This practice, however, had two disadvantages; first, that unless the aircraft were fairly close to the chosen point at a certain time, the azimuth at the place of observation might be considerably different and the accuracy would suffer unless the curvature of the position line were allowed for. The second disadvantage was the extra amount of work entailed in preparing curves on the ground compared with the computation of a single altitude in the air.

As a matter of fact, however, such curves were actually used at the end of this flight, when it was necessary to make a number of observations at short intervals. But they were prepared during the flight when it was known to within a few miles where the aeroplanes would be.

A description is given of the method of using a D.R. computer to correct the previously used wind, and also to find the course to fly during the next run in order to allow for both the corrected wind and the leeway accumulated during the last run.

The reader will realise how the work (1) of fixing the position after obtaining the star observations, (2) of determining the ground speed, (3) of deciding the position at the exact half past the hour or at the hour, and (4) of working out the course for the next half hour lends itself to simplification by drill or routine on the part of the navigator.

* * *

On the way up through the clouds Drake had estimated that the aircraft would be in level flight at 25,000ft. before 23.30 G.M.T. and had instructed two of his navigators to precompute the altitudes and azimuths of both stars for the point G 6½° W. 49½° N. as a chosen position at 23.30 G.M.T. One navigator used the cosine formula and the other the Bygrave Position-Line Slide Rule. (The navigator who used the cosine formula had taken out the Log Sines and Cosines of both star declinations before the flight. He had therefore only to take out the Log Sine and Cosine of the Latitude and the Log Cosine of the Hour Angle for each computation.)

The Bygrave, which works from either a D.R. position or a chosen position, computing the altitude to within 2′ accuracy, was not accurate enough for the navigation of this flight, but it provided an invaluable check of work done by tables, and, in the course of calculating the altitude, calculated the azimuth. If, therefore, the altitude by the Bygrave agreed closely with the altitude by tables, then the azimuth could be accepted without further checking. Another point in favour of the Bygrave was that the risk of making a mistake with it at 25,000ft. was less than when using tables. As will be seen, the navigator using the cosine formula did make a slip.

In parenthesis, it should be noted the French Air Almanac, the *Ephémérides Aeronautiques*, was used throughout for the navigation of this flight. The reason for this was that it gives all quantities to the nearest ½′. Quantities given to the nearest 1′ were not accurate enough for the precise navigation demanded. This Almanac gives the Greenwich Sidereal Time as "*Sidéral*" for every 20 minutes of G.M.T. It records the S.H.A., or Sidereal Hour Angle, under the heading of "Ascension Verse" for every celestial body likely to be observed, including the sun. As the Ascension Verse, or Sidereal Hour Angle (S.H.A.) is the hour angle between Aries and the star, and as the *Sidéral* or Greenwich Sidereal Time is the hour angle between Greenwich and Aries, it is only necessary to add the two to obtain the Greenwich hour angle of the star. Deducting the West Longitude of the place of observation gives the local hour angle of the star required to calculate the altitude.

The precomputation by the cosine formula was as follows:

Aug. 13, 23.30.00 G.M.T.		
At 23.20.00, Sidereal time at Greenwich ..	311°	29½′
For 10 minutes add	2°	30′
Sidereal Hour Angle or Ascension Verse Alioth	167°	09½′
Greenwich Hour Angle of Star ..	481°	09½′
Longitude West .. .. .. —	6°	45′
Local Hour Angle West	474°	24½′
	= 114°	24½′

Sin Alt = Sin Lat Sin Dec + Cos Lat Cos Dec Cos Hour Angle.

Alioth.
Log (Sin Lat Sin Dec)
= Log Sin Lat 49° 30′ .. 9.88105
+ Log Sin Dec 56° 17½′ .. 9.92006
= 9.80111 (which is the log of the nat. No. 0.632572).

Log (Cos Lat Cos Dec Cos Hour Angle)
= Log cos Lat 9.81254
+ Log cos Dec 9.74427
+ Log cos H.A. 114° 24½′ 9.61620
= Sum of above = 9.17301 (which is log of nat. No. 0.148939).

∴ Sin Altitude =
Sin Lat Sin Dec 0.632572
+ Cos Lat Cos Dec Cos H.A. 0.148939
= 0.781511 (which is the sine of 51° 24′)

therefore the alt. of Alioth at 23.30 G.M.T. was 51° 24′.
Check by Bygrave.

$$\gamma = 105° 24\tfrac{1}{2}'$$
$$\text{colat} = 40° 30'$$
$$\therefore = \text{colat} + \gamma = 145° 54\tfrac{1}{2}'$$
$$A = \text{S. } 144° 43' \text{ W.} = \text{N. } 35° 17' \text{ W.}$$
$$a = 28° 55'$$

Obviously some mistake had been made. On looking through the cosine work it was found that natural numbers making up the sine of the altitude had been added together instead of the one being subtracted from the other, as should have been done; the H.A. exceeded 90° and therefore its cosine was negative.

Sin alt = 0.632572
− 0.148939
= 0.483633

which is the sine of 28° 55½′. This should be, therefore, the altitude of Alioth at 23.30 G.M.T. if the aircraft were at point G (see chart).

The altitude and azimuth of Capella were computed for 23.30 G.M.T. in the same way. By the cosine formula the altitude was 14° 33½′. By Bygrave the altitude was 14° 33½′, the azimuth North 32° 56′ East. (Capella's declination is 45° 56½′ North and Sidereal Hour Angle 281° 57′.)

Drake plotted the precomputed bearings of Capella and Alioth from the chosen position 49° 30′ North, 06° 45′ West at 23.30 G.M.T. and gave the word for his team to get busy. The four observers took their stand under the observing superstructure, each man steadying himself with one hip against a railing placed there for the purpose. At the same time they stood firmly on their feet, avoiding contact of their shoulders with anything. In this position their bodies acted as vibration dampers. Each took a six-shot observation of Capella with an averaging bubble sextant. As soon as an observer had the star and the bubble coincident for the third shot he started a stop-watch on the sextant. As soon as he had finished the series he handed his sextant to his assistant, who read off the stop watch and deducted the number of seconds indicated on it from the G.M.T. of his own watch (this, of course, had been corrected before the start). He also read the average of the six sights, wrote it down with the time on a slip of paper and handed back the sextant. The times and altitudes were passed over to Drake sitting at his chart table in the navigation cabin on the other side. Drake added the four times and the four observations.

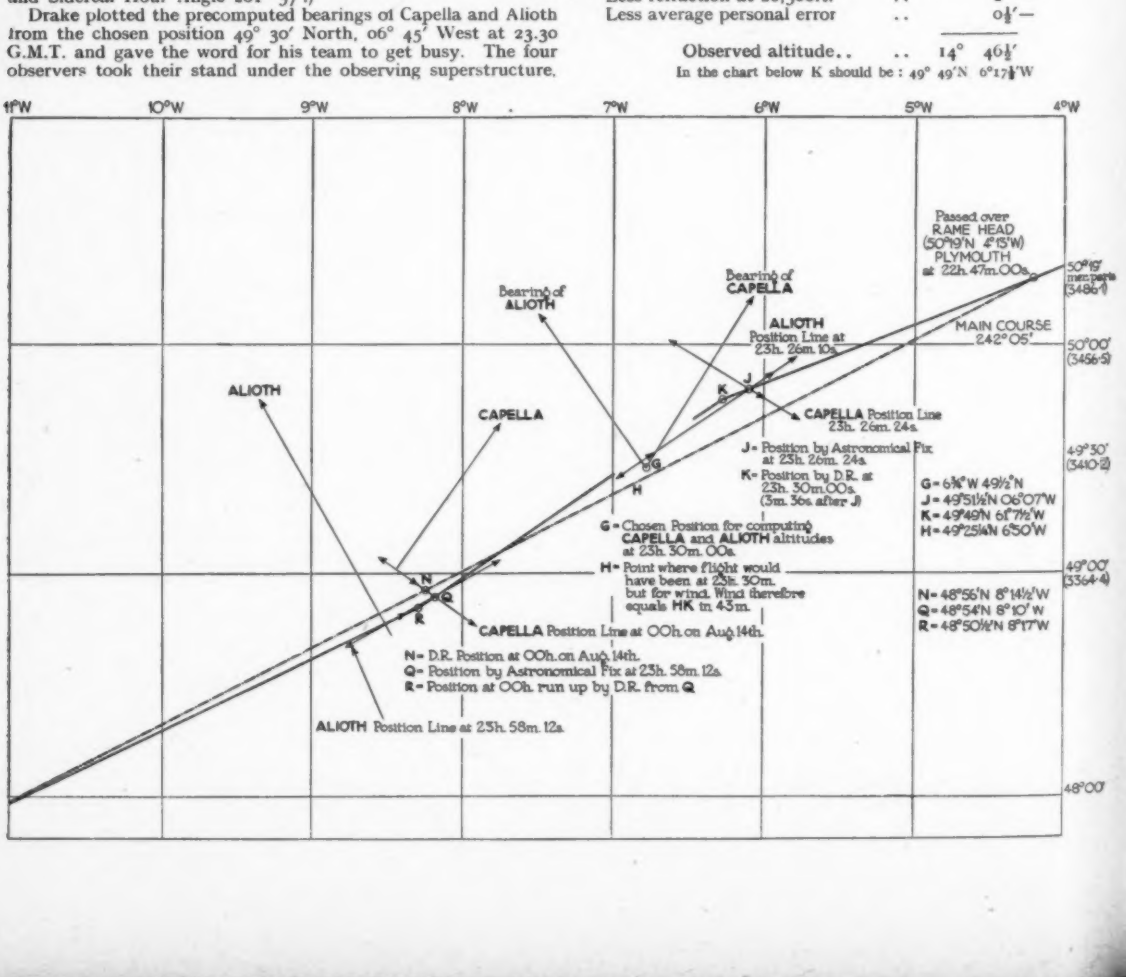
Each observer meanwhile had put himself into position and begun sighting Alioth.

Exactly the same procedure was adopted as for Capella. Each observer then took a second series of Alioth, and immediately after that a second series of Capella. Before Drake received the Capella results he had the eight series of Alioth sights, totalling 48 single sights of the star, added together, averaged, and combined with the average of the four personal errors and with the refraction. He also averaged the eight times.

For the Capella observation the sextant readings and times for the eight series of six single shots were :—

G.M.T. h.	m.	s.	Sextant Average Readings
23	24	43	14° 40′
—	24	50	14° 40½′
—	25	00	14° 36½′
—	25	05	14° 44½′
—	27	45	14° 54½′
—	27	43	14° 54½′
—	27	56	14° 59′
—	28	10	15° 01½′
	8)211	12	8)391′

Average time : 23h. 26m. 24s.
Average of 48 sextant altitudes .. 14° 49′
Less refraction at 26,500ft. .. 2′ —
Less average personal error .. 0½′ —
Observed altitude.. .. 14° 46½′
In the chart below K should be : 49° 49′N 6°17½′W


11°W
10°W
9°W
8°W
7°W
6°W
5°W
4°W
Passed over RAME HEAD (50°19'N 4°15'W) PLYMOUTH at 22h. 47m. 00s.
50°15' mercparts (3486·1)
Bearing of ALIOTH
Bearing of CAPELLA
ALIOTH Position Line at 23h. 26m. 10s.
MAIN COURSE 242° 05′
50°00' (3456·9)
ALIOTH
CAPELLA
CAPELLA Position Line 23h. 26m. 24s.
J = Position by Astronomical Fix at 23h. 26m. 24s.
K = Position by D.R. at 23h. 30m. 00s. (3m. 36s. after J)
49°30' (3410·2)
G = 6¾°W 49½°N
J = 49°51½'N 06°07'W
K = 49°49'N 6°7½'W
H = 49°25¼'N 6°50'W
G = Chosen Position for computing CAPELLA and ALIOTH altitudes at 23h. 30m. 00s.
H = Point where flight would have been at 23h. 30m. but for wind. Wind therefore equals HK in 4.3m.
49°00' (3364·4)
N = 48°56'N 8°14½'W
Q = 48°54'N 8°10' W
R = 48°50½'N 8°17'W
CAPELLA Position Line at OOh. on Aug. 14th.
N = D.R. Position at OOh. on Aug. 14th.
Q = Position by Astronomical Fix at 23h. 58m. 12s.
R = Position at OOh. run up by D.R. from Q
ALIOTH Position Line at 23h. 58m. 12s.
48°00'

The average time of the Capella sights was 23h. 26m. 24s. G.M.T. The precomputed time was 23h. 30m. 00s. G.M.T., a difference of 03m. 36s. Referring to the Rate of Change of Altitude per Minute of Time table* it was seen that with azimuth 33°, latitude 49½°, the rate of change was 5.3′ per minute. The altitude at G at 23h. 26m. 24s., 3.6 minutes earlier, should have been, therefore,

$14° 33\frac{1}{2}' - 3.6 \times 5.3' = 14° 33\frac{1}{2}' - 19' = 14° 14\frac{1}{2}'$.

AZIMUTH, AND CORRESPONDING CHANGE OF ALTITUDE IN 1ᵐ OF TIME

Lat.	Change of Altitude in 1ᵐ											
	0′	1′	2′	3′	4′	5′	6′	7′	8′	9′	10′	11′	12′
45°	0°	5°	11°	16°	22°	28°	34°	41°	49°	58°	71°		
46	0	5	11	17	23	29	35	42	50	60	74		
47	0	6	11	17	23	29	36	43	51	62	78		
48	0	6	11	17	23	30	37	44	53	64	85		
49	0	6	12	18	24	31	38	45	54	66			
50	0	6	12	18	25	31	38	47	56	69			
51	0	6	12	19	25	32	39	48	58	72			

The observed altitude was 14° 46½′, or 32′ greater. The position line at 23h. 26m. 24s. was, therefore, 32′ nearer Capella than the chosen position, and perpendicular to a line drawn from the chosen position towards Capella.

The average time of the Alioth sights was 23h. 26m. 10s. G.M.T., which was 14 seconds earlier than the time for the Capella sights. For precise navigation the Alioth position line for that time should have been transferred to allow for the aeroplane's flight during 14 seconds. As, however, Alioth was within 14° of being on the beam, the correction would have been negligible and was passed over. (The aeroplanes would have flown 0.6 mile in 14 seconds. The amount which the position-line should have been transferred was $0.6 \times \sin 14° = 0.15$ mile, or about 300 yards only.)

The precomputed altitude of Alioth at 23h. 30m. 00s. was 28° 55½′. In Lat. 49½° and with azimuth 35° the Rate of Change of Altitude per Minute of Time was seen in the tables to be 5.6′. The altitude at G at 23h. 26m. 10s., 3m. 50s. earlier, would, therefore, have been $3.8 \times 5.6' = 21\frac{1}{2}'$ greater, namely, 29° 16½′. The observed altitude was actually 29° 19½′, which was 3′ greater. The formation at 23h. 26m. 10s. was therefore on a position-line 3′ nearer the star than the chosen position G.

The two position lines were plotted and it was found that the aircraft at 23h. 26m. 24s. were at J (49° 51½′ N., 06° 07′ W.). The distance flown to J was 78 miles in 39.4 minutes; 3m. 36s. later, at 23.30, that is to say, after 43 minutes, the bombers at the same speed would have flown 85 miles.

A line from Rame Head through J was produced another 7 miles to the point K (position of K, 49° 49′ N., 6° 17½′ W.), which was then taken to be where the formation would be at 23.30.

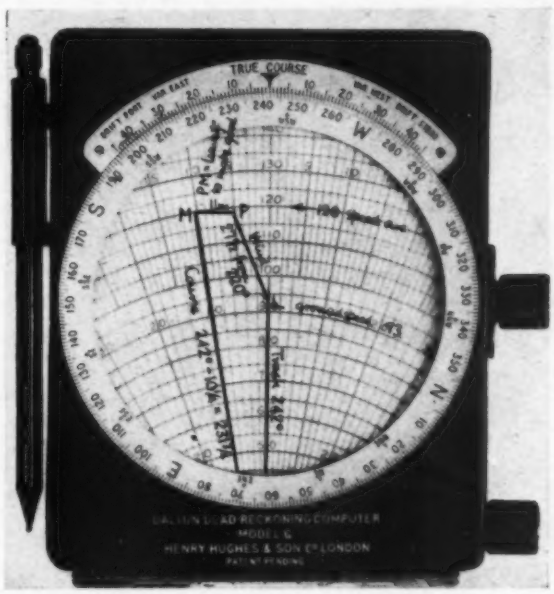
Finding the Wind

It was realised that the wind during the flight from J to K would not be the same as the average wind during the climb. But a difference of 10 knots in the wind speed would cause an error of only 0.6 of a mile in 3.6 minutes' flight. This could be disregarded in practice. (In point of fact this inaccuracy, however large, could hardly be allowed for, unless an unchanged course for half an hour was flown from J until another position fix was obtained. This would have taken the flight off its course farther than Drake wished. He preferred to start the high-altitude navigation from K with a small error of less than a mile. This would enable him to get the wind worked out and the course computed during the flight from J to K, and would also enable him to start at the exact half-hour, 23.30 G.M.T.) At 23.30 G.M.T. the formation would have been in the air 43 minutes, since passing over Rame Head. Had there been no wind the flight would have been at H, 114½ miles along the course from Rame Head. This 114½ was made up as follows: On the way up, 66 miles flown in 25 minutes. From the time of changing the air speed to 107 knots (true air speed, 162½ knots) until 23.30 G.M.T., distance flown 48.6 miles (i.e., distance flown in 18 minutes at 162½ knots). Total air distance flown in 43 minutes to 23.30.00 G.M.T., 114.6 miles. A point H was marked on the chart 114½ sea miles from Rame Head (H 49° 25′ N., 6° 50′ W.). The aircraft should have been at H, and therefore a wind of direction HK had driven them off course by an amount equal in force to the length of HK per 43 minutes. The length of HK equalled 32 miles, and therefore the average wind force up to this point was 44½ knots and from 221½°.

At 23.30 Drake gave orders to increase the indicated air speed for a true air speed of 240 knots. To find the indicated air speed at which to fly, Drake used the air speed corrector of his Dalton "G" D.R. Computer. Against the temperature −23° C. he set the indicated altitude, 26,500 ft. On the rotatable disc he read off the indicated air speed, 158 knots, at which to fly to maintain a true air speed of 240 knots. He estimated that the wind at this height would be 55 knots from 220°.

During the next half-hour the air distance covered would be 120 miles.

To find the course to fly to get back to the main course in half an hour's flight, allowing for a wind of 55 knots from 220°, and making good the distance off course at K (11 miles), Drake set the Dalton "G" D.R. Computer with 220° at the index.



How the Dalton computer was used to find the course to fly in order to regain the main course in half an hour.

He plotted a wind arrow PL of 27½ miles (the wind for half an hour at 55 knots) to the centre of the plotting disc L and from the direction of 220°. He then rotated the disc to bring the main course 242° to the Index. From the beginning P of the wind arrow he then plotted a line PM 11 miles in length (the distance off course at K) from the beginning of the wind arrow away from the course 242° and perpendicular to it. Lastly, he adjusted the fan diagram until the speed arc representing 120 miles (half an hour's flight at 240 knots) passed under the point M. M was seen to be 10½ degrees to the left of the main course 242°, and therefore the course to steer during the next half-hour to bring the aircraft back on to the main course was $242° - 10\frac{1}{2}° = 231\frac{1}{2}°$. The expected ground speed was shown at L to be 93 miles in the half-hour.

Counter-checking

With centre K and radius 93 miles, he drew an arc to cut the main course at N. Then N was the D.R. position for 00 hours G.M.T. Alternatively, the course to fly and the ground speed during the next half-hour could have been found accurately, if required, by simple plane trigonometry (considerations of space unfortunately preclude a detailed demonstration).

The compass course ordered by Drake was now 248½° made up of 242° main course − 10½° + 14° magnetic variation +3° deviation west.

Drake deputed two other assistants to compute the altitudes and azimuths of Alioth and Capella for August 14th 00 hours for a chosen position near N.

One used the Hughes-Comrie tables (see new edition *Admiralty Manual of Navigation, Volume II*; Chapter XV is a full description of the tables), with Latitude 49° 00′, while the other checked by the Bygrave.

* This extremely valuable table, found only, as far as I know, in Raper, should be included as a page in every set of tables.

August 14th 00 00 00 hours.

Sidereal	.. .. ..	321° 31′
S.H.A. or A.V. Alioth	..	167° 09½′
		488° 40½′
G.H.A...	.. .. ..	128° 40½′
Long West	.. .. ..	8° 40½′
Local H.A. West	.. ..	120° 00′

Dec. + 56 17½
K + 113 29½

K—Dec. 57 12 A 8465 D 246 Z_1 −37.4°
B 26623 E 191 Z_2 +69.9°

A+B 35088 D+E 437 $Z_2 - Z_1$ = N. 32.5 W.
a = 26° 28.5′

Check by Bygrave :—
A = N.32° 28′ W.
a = 26° 27½′

I—LATITUDE 49°

	h	K	A	D	Z_1	
180°	45	58° 25·3′	5263	334	53·0	135
179	46	58 52·4	5471	326	52·0	134
178	47	59 20·3	5682	319	51·0	133
165	60	66 30·5	8465	246	37·4	120
164	61	67 08·9	8672	241	36·3	119

The computation in this case by the Hughes-Comrie tables was done as follows: In Table I, on the page corresponding to the latitude degree, 49°, and against the hour angle 120° at the side of the page, the following quantities were read off: 180-K, 66° 30.5′. A, 8465. D, 246. $-Z_1$, 37.4. K was found by deducting 66° 30.5′ from 180° and given the sign of the latitude K 113° 29.5′ + A 8465 D 246 $-Z_1$ 37.4. From K the declination + 56° 17½′ was subtracted to make K-d

K 113° 29½′ +
dec 56° 17½′ +
K − d 57° 12′

114 TABLE II

	55°		56°		57°		58°	
	B	C	B	C	B	C	B	C
00·0	24141	8664	25244	8143	26389	7641	27579	7158
00·5	24150	8659	25253	8138	26399	7637	27589	7154
11·0	24340	8567	25451	8049	26604	7551	27802	7071
11·5	24349	8562	25460	8045	26614	7547	27812	7068
12·0	24358	8558	25469	8041	26623	7543	27823	7064
12·5	24367	8553	25479	8036	26633	7539	27833	7060
13·0	24376	8549	25488	8032	26643	7535	27843	7056
13·5	24385	8545	25498	8028	26653	7531	27853	7052

In Table II, in the column headed 57° and opposite 12′ at the side, the quantity B was taken out and added to A.

B 26,623
A + B 35,088

This quantity A + B was looked up in column C of the same table, and at the head of the column the number of degrees in the altitude was read off, 26°, and at the side of the page the number of odd minutes, 28.5′; the altitude was, therefore, 26° 28.5′.

TABLE III

K−d or Z_2	0′ ·0	6′ ·1	12′ ·2	18′ ·3	24′ ·4	30′ ·5	36′ ·6	42′ ·7
45	0	2	3	5	6	8	9	11
46	18	17	18	20		23	24	26
55	155	156	158	160	161	163	164	166
56	171	173	174	176	178	179	181	183
57	187	189	191	192	194	196	197	199
58	204	206	208	209	211	213	214	216
59	221	223	225	226	228	230	232	233

To find the azimuth, Table III was used. Against the quantity K − d, 57° 12′, the quantity E was found to be 191. This was added to D. D + E = 246 + 191 = 437, which was looked up in the body of the same Table III; in the column at the side of the page and in the line containing 437 was read off the quantity Z_2, + 69.9°, which, when added to Z_1, gave the azimuth 32.5° reading from the elevated pole, North, and West because the hour angle was West.

In the same manner the altitude of Capella, working from a chosen position 49° N., 8° 28′ W., was found by the tables to be 16° 18′ and by Bygrave to be the same quantity. The azimuth by Bygrave was found to be N. 36° 24′ E.

The eight sets of six observations of Capella, making 48 observations in all, were taken as before. The observations corrected for refraction and personal error averaged 16° 10½′, and the times averaged 23h. 58m. 12s.

The times of the Alioth sights came out at 23h. 57m. 50s., 22 seconds earlier than those of Capella. Alioth, however, was on the beam of the track from K to N, therefore any position lines from it were approximately parallel with the course, and it was not necessary to make any adjustment for flight during the 22 seconds—it would be along the position line.

The computed Capella altitude for 00 G.M.T. must be adjusted to the time of the actual observation, 23h. 58m. 12s., 1.8 m. earlier.

From Raper's table, "Azimuth and corresponding change of altitude in 1 minute of Time," for azimuth 36°, latitude 49°, the rate of change was seen to be 5.7′. (These rates of change were taken out at the time of the precomputation.) The computed Capella altitude for the time of observation was therefore 16° 18′ − 10½′ = 16° 07¾′.

By observation it was 16° 10½′, namely, greater by 2¾′. And therefore the Capella position line was 2¾ miles nearer the star than the chosen position.

The Alioth observations averaged 26° 24′ at the average time of 23h. 57m. 50s. The computed Alioth altitude at 00 00 00 hours, 2m. 10s. later, was 26° 28½′. The rate of change at latitude 49° with azimuth 32½° was 5.2′, and therefore the computed Alioth altitude at time of observation was 26° 28½′ + 11½′ = 26° 39¾′. The observed altitude was 26° 24′, namely, 16′ less. The Alioth position-line was therefore 16 miles from the chosen position and away from the star.

The aircraft's position 1.8 minutes before 00 00 00 hours was Q, 48° 54′ N., 8° 10′ W., where the position-lines crossed.

The track KQ must be produced by the distance flown in 1.8 minutes, in order to ascertain the position at 00 00 00 hours. In 28.2 minutes the aeroplanes had flown 140½ meridianal parts or minutes of longitude on the chart.

Mer. parts of Lat. 50 = 3,456.5
− 140.5
3,316.0 which are the mer. parts of 48° 28′.

Length of flight therefore 50° − 48° 28′ = 92 miles.
In 28.2 minutes, 92 miles flown.

In 1.8 minutes $\frac{1.8}{28.2} \times 92 = 5.9$ miles flown.

The wind, 55 knots from 220°, was inaccurate in the half-hour by the difference between the D.R. position N. and the actual position R.

Instead of having been 27½ miles from 220° per half-hour, it had been 27½ from 220° combined with 5½ from 181°; double these quantities gave the wind per hour. Using the Dalton "G," the correct wind for the half-hour was found to be 23 miles from 225°.

Therefore, during the next hour's flight, double this wind had to be allowed for, namely, 46 knots from 225°. In addition, a distance equal to the perpendicular from R to the main course had to be allowed for to bring the formation back to the main course. This perpendicular = NR sin the angle between NR and the main course.

Direction of NR 198° 26′
of the main course 242°
∴ The perpendicular = 5½ Sin 43° 34′ L Sin 1.8383
= 3.62′ L 5½ 0.7202
L 3.6′ = 0.5585

As before, Drake plotted on the Dalton "G" this perpendicular vector 3.6′ from 242° + 90° = 332° and combined it with a wind vector 46 knots from 225°. The course to fly was read off as 2¾° to the left of 242° = 239¾° and ground speed 196 knots.

With centre R and radius 196 miles, Drake drew an arc to cut the main course at U. Then U was the D.R. position at 01 hours G.M.T. His compass course was 239¾° true + 15° magnetic variation W. + 3 deviation W. = 258°. The position of U was 47° 21½′ N. 12° 37½′ W.

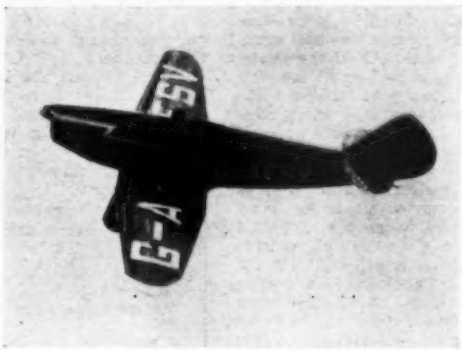
At 01 50 G.M.T. he had the compass course changed to 259° comprising true course 239¾°+16° variation W.+3° deviation W.

(To be continued in an early issue)

MORE POWER for the CHILTON

Fighter-like Performance for Train-engined Version : Unchanged Characteristics

QUITE a number of pilots, both experienced and inexperienced, have now flown the little Ford-engined Chilton single-seater. Those who have not been initially terrified by the somewhat diminutive size of the machine, and those who have had the opportunity, in any case, to get to know it, all agree that it is by way of being a very remarkable little aeroplane. Not only are the handling qualities exceptional at all speeds, but the machine is reasonably viceless and, even with the low power-to-weight ratio of the water-cooled Ford engine, the take-off run is short, and the climb safely useful.



Judging from the manufacturers' experience, there is no need to feel any doubts about the capacity of the Ford engine, both in the matter of long-distance reliability and performance-holding. In fact, the Chilton has shown designers what can be done even with an engine which can hardly be considered as efficient from the flying point of view.

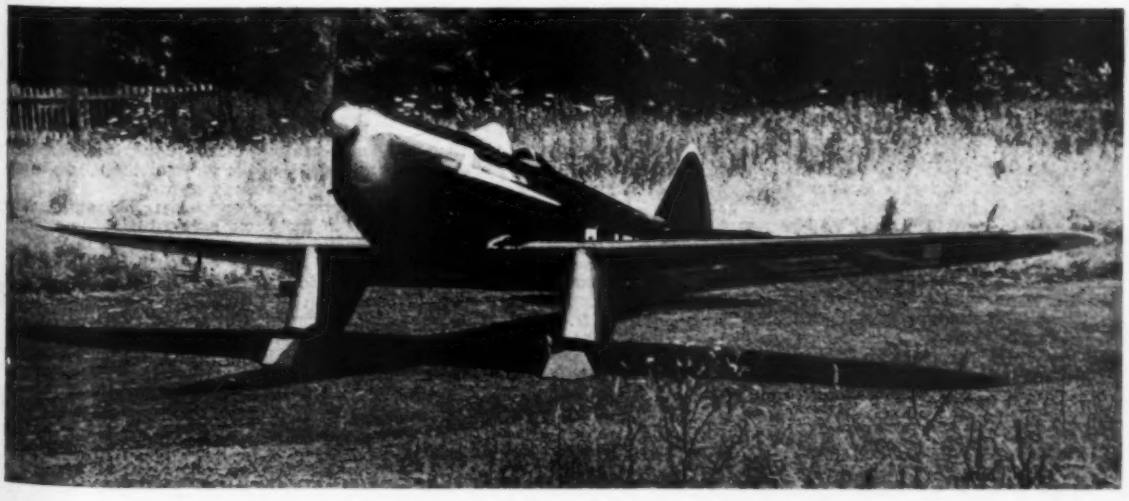
However, those who want a real aero engine can now buy the Chilton with a 40 h.p. Train engine. Though giving more power, this engine is actually lighter than the Ford and, to mention a superficial and unimportant matter, has considerably improved the lines of the machine. The Train 4.T. engine is an inverted four-in-line air-cooled unit, the most interesting feature of which is the overhead (or underhead) camshaft, which is driven by bevel gearing directly from the rear of the crankshaft. The maximum rated output is 44 h.p. at 2,350 r.p.m., and the Chilton people, who partly dissembled their first example, say that it is very sturdily built. Dry, the Train weighs a little over 100 lb., against the 130 lb. of the converted Ford engine—which delivered a maximum of 33 h.p. at the less airscrew-efficient speed of 3,500 r.p.m.

Without actually leaping straight from the Train-engined machine to one with the Ford engine—and there was no example of the latter available when I flew the new type—it is not possible to say that the new engine makes no difference to the handling characteristics. Certainly, however, these seemed to be just the same, though the lower weight of the new engine may possibly have very slightly altered the stalling characteristics. These are still safe enough, but the full stall arrives a little more suddenly and the left wing drops away. The Ford-engined version stalled on a level keel.

Needless to say, the new engine makes quite a considerable difference to the performance. In the Folkestone Trophy race three weeks ago the prototype averaged 126 m.p.h. round the triangular course with a 15 m.p.h. wind blowing. Allowing for the fact that Mr. Dalrymple probably dodged the wind as far as possible, this figure, with the necessity for tight turns, means that the ordinary maximum is at least 130 m.p.h. On the airspeed indicator, which had been checked, the machine cruised (2,050 r.p.m.) at a little over 110 m.p.h. at 2,000ft.; after making allowance for height error, this gives a cruising speed of about 115 m.p.h.—which is certainly quite enough on a great deal less than 40 h.p.

During a trip from Marlborough to Land's End, back to Hungerford and Marlborough, with a great many sight-seeing deviations, pauses for minor aerobatics and an unswung compass, the crow-flying distance of 415 miles was covered, including take-offs, circuits, climbs, descents, and landings, in an inclusive time of 4 hr. 25 min. This provides a good steady working average figure, for normal flying, of 94 m.p.h.—96 m.p.h. out and 92 m.p.h. home. The fuel consumption worked out at rather less than 3 gallons an hour, which tallies fairly well with the official figure of 2¼ in ideal cruising conditions.

Most remarkable of all, however, is the initial rate of climb. The makers give it as 1,000ft. per minute, and without a stop watch it was not possible to check this figure. However, I found that just about four minutes was taken to climb to 3,000ft. on full throttle without seriously attempting to hold the best climbing speed. Curiously enough—though the fact may be an illusion—the take-off run does not appear to be very much shorter than that of the Ford-engined version. Obviously, with more power and a more efficient airscrew it must be, and the probability is that the rather higher cowling line and the slight initial difficulty in settling the machine down on a straight course during the take-off contribute towards this effect—in other words, I was not making it fly as soon as it could have done. Not unnaturally, there is a fairly pronounced swing to the right during the take-off. This does not occur when the throttle is first opened, but as the machine gathers speed and the airscrew becomes, consequently, more efficient. There is ample rudder to correct the swing, but newcomers should be prepared for it, and try not



The clean and "pretty" lines of the new Chilton are well shown in this picture—taken against a Savernake Forest background

to take off in a series of over-correction swerves. Actually, the undercarriage is so wide that it is difficult to imagine that any catastrophic results would occur even during the most careless and unhappy departure.

The majority of my take-offs and landings were made from the Earl of Cardigan's little field, which is used by Chilton Aircraft as the nearest landing ground to Hungerford. The ground there is distinctly rough—so much so that a passage over it in a car at 30 m.p.h. is a terrifying and back-breaking experience. But this field, with its odd approaches and small dimensions, at least gave a very good idea both of the safety of the take-off and of the initial climb, as well as of the way in which the Chilton can be brought in to a spot landing without the use of any such old-fashioned aids as side-slipping. The split flaps on the machine have half a dozen positions, and the best way of graduating an approach is to go round in a gentle turn while applying more and more flap as conditions appear to demand. In five approaches and landings in flat calm conditions over a usable run of rather less than 400 yards there was never any necessity to use the motor or to go round again. It is quite safe to glide the Chilton at a little more than 50 m.p.h., gathering, perhaps, a little more speed before the final touch-down, though in windy conditions either more speed or less flap should be used. The more efficient airscrew, even at tick-over speed, tends to extend the landing run, but there should be no need to fit brakes to this version of the machine. On the ground in ordinary conditions (there was a 15 m.p.h. wind blowing at another aerodrome visited), it is fully controllable on rudder and slipstream alone, and only with half a gale would it be necessary to have someone at the wing tip.

There is no need to emphasise the remarkable handling characteristics of the Chilton, since these are much the same as before—though the additional power gives aerobatically inclined pilots a chance to carry out some fairly extreme manœuvres without loss of height. This fact has already been shown at one or two flying meetings. But it is, perhaps, necessary to mention once again the tidiness of the layout. Though extremely small, the cockpit allows ample room, and everything is placed where it should be placed. Furthermore, all the fittings are rigidly attached, and even the necessary pipelines and other items are neatly installed and do not obtrude. Other light aeroplane manufacturers may usefully glance over the Chilton.

It is both possible and practical to fly the machine without goggles, though advisable to use them during the take-off and final approach, as it is then sometimes necessary to look fairly well out beyond the little screen. There is a usefully large luggage locker immediately behind the seat in which any ordinary case or cases can be strapped, as well as another locker above it for incidentals. There are map-holders on each side of the cockpit. Finally, the Chilton-designed aerobatic harness may also be used as a lap-strap for normal flying.

H. A. T.

CHILTON MONOPLANE
44 h.p. Train Engine

Span	24ft.
Length	18ft.
Weight empty	380 lb.
All-up weight	650 lb.
Maximum permissible weight	700 lb.
Wing loading	8.4 lb./sq. ft.
Power loading	14.8 lb./h.p.
Maximum speed	135 m.p.h.
Cruising speed	115 m.p.h.
Landing speed	35 m.p.h.
Initial rate of climb	1,000 ft./min.
Normal range	400 miles
Price	£375

Makers: Chilton Aircraft, Hungerford, Berks.

KING'S CUP ARRANGEMENTS

Times of the Events : Two Flying Displays : Advice to Visiting Pilots

THE times of the races for the King's Cup and for the Wakefield Challenge Trophy have now been settled by the Racing Committee of the Royal Aero Club.

Competitors, of whom there are 26 in the two events, will arrive at the Airport of Birmingham, Elmdon, at noon on Friday, September 1, for checking and handicapping. The first race will begin at 9 a.m. on Saturday, September 2. The times of each event are as follows:—

FIRST RACE (King's Cup), 9 a.m. SECOND RACE (Wakefield Trophy), 10 a.m. THIRD RACE (King's Cup), 11.30 a.m. FOURTH RACE (Wakefield Trophy), 1.30 p.m. FIFTH RACE (King's Cup), 2.45 p.m. SIXTH RACE (Wakefield Trophy Final), 4 p.m. SEVENTH RACE (King's Cup Final), 5.15 p.m.

Racing is expected to end at 6 p.m., when Sir Kingsley Wood will present the prizes. The Air Minister has also consented to present the prizes and souvenirs (provided by the Dunlop Rubber Co.) for the arrival competition.

On Friday evening, September 1, there will be a flying display. No. 605 (County of Warwick) Squadron, A.A.F., will take part, and the Air Ministry is allowing a Boulton Paul Defiant to contribute an item. Other aircraft promised include the Hawker Hurricane (civil test model), the C.40 Autogiro, and Mr. Shuttleworth's pre-war Deperdussin. The display will commence with an arrival contest between 6 and 6.45 p.m.

Airline traffic will be diverted to Castle Bromwich aerodrome on September 2. Other aircraft will not be allowed to land on September 2 at the Airport of Birmingham except between the hours of 12.30 p.m and 1.15 p.m.

The flying display will be repeated in identical form on Saturday evening, September 2.

All private owners and visiting pilots will be welcomed at the Airport on Friday evening, September 1, in the arrival contest, or on September 2 between 12.30 and 1.15 p.m. in the case of those who cannot arrive overnight. Pilots arriving on the Friday should bring pickets and engine covers, as hangarage will not be available.

All enquiries respecting the arrangements should be addressed to the organiser, Mr. William Courtenay, at the Airport of Birmingham, Elmdon (Sheldon 2441).

R. L. HOWARD-FLANDERS

ANOTHER British aviation pioneer has passed from our ranks. Mr. Howard-Flanders died at Bristol on August 12 after an operation, and so ends a life which had in it much of tragedy and less-than-merited success.

Richard Leonard Howard-Flanders was born in Italy of British parents in 1883, was at Emmanuel College, Cambridge, and passed through the University Engineering Laboratory. After leaving Cambridge he served his apprenticeship with Brazil Straker and Co., of Bristol, and in 1909 he joined A. V. Roe, afterwards becoming manager to J. V. Neale. In 1910 he formed his own company at Brooklands, and there designed and built a considerable number of monoplanes, a type of which he was a staunch advocate. For the Military Trials of 1912 he designed and built a biplane. It was damaged in a landing test and could not be repaired in time to take part in the trials proper.

Shortly afterwards Flanders met with a serious accident while motor cycling, and his convalescence, including a cruise, was so long that his little company had to close down. That this should be so was a great loss to British aviation, for not only would Howard-Flanders have produced some very good aeroplanes, but those which he did produce were built very cheaply indeed, as had to be most of the efforts of the pioneers, few of whom were wealthy men.

Shortly before the outbreak of war in 1914 Howard-Flanders joined Vickers, Ltd., in the aircraft department, transferring to the engine section in 1917.

After leaving Vickers, Howard-Flanders became something of a rolling stone, and did not, except for a brief period in the aircraft department of the English Electric Co., under Mr. W. O. Manning, return to actual aircraft design, although he held secretarial and other posts in institutions connected with flying. At the time of his death he was on the staff of the Bristol Aeroplane Co., Ltd.

The tragedy of the life of Howard-Flanders was that his technical ability was never properly applied. He was "difficult," as the saying goes; apt to speak his mind and not over-diplomatic. Most of his life he managed to exist on a very small income, and it is to be feared that his dependants are left none too well provided for. We suggest that the aircraft industry should make it its business to extend a helping hand.

COMMERCIAL AVIATION

THE WEEK AT CROYDON

Fruitful Forgetfulness : Delicacies for Deauville : This Air Congestion : Slack Aircraft-parking : Nerve-war Declared by "Works and Bricks"

ABSENTMINDEDNESS brought a couple of fruitful jobs to air charter firms last week. One was by Olley Air Service and the other by Air Taxis, Ltd., the pilot of the latter firm being Miss Mona Friedlander (or should one say Capt. Friedlander, for they are all "Captains" in the air transport business, so far as I can make out?). Both jobs were to carry passports, forgotten by their owners, to Southampton in order to catch the *Queen Mary* before she sailed.

North-Eastern Airways brought fresh salmon, caught in the morning, from Perth to Croydon, where it was transhipped to Olley's Deauville service and consumed there for dinner the same evening.

Lord Faversham made the journey Rome-Croydon by air and then took North-Eastern's connection for Newcastle one day last week, thus breakfasting in Rome and dining in Newcastle.

A Johannesburg business man on holiday in England hired an "Olley" Rapide for his small daughter, who had whooping cough. Forty-five minutes at 10,oooft. will have cured her, it is hoped.

Super Charter-Flying

K.L.M., besides selling a Lockheed 14 to British Airways, also sold a Fokker four-motor F.22, which is a 22-passenger machine, to British American Air Services, of Heston. The intention is to fit this big liner with a more than usually up-to-the-minute bar and use it as a "race special" which will be available for all the big race meetings and will invariably, I understand, call at Newmarket *en route*.

Mr. Winston Churchill flew to Paris on Monday of last week to cast an expert glance at the Maginot Line, and on Thursday the visit was returned by hundreds of French bombers and fighters. Praise be, the weather was fine, and civil aviation survived both mimic attackers and attacked.

Reason given by one rapidly greying civil pilot for faster transport aeroplanes was the dire necessity of dodging the jolly old military. Another, who had been startled out of his few remaining wits by cloud-shielded barrage balloons, voted for hover-planes for commercial use, from which you could let down a ladder and descend when hemmed in on all sides by balloons.

Not long ago civil pilots, most of their flying being done for them by robot pilots, or, at a pinch, by first officers, tended to become bored. All that is altered now, and civil flying has all the thrill of swimming in shark-infested lagoons. The other day, they say, a British pilot flying over friendly territory with a large air liner of a type new to that particular route, received a salute of guns equal to that usually accorded to an admiral. He radioed asking to what he owed the pleasure and they sent back to say sorry, but they had mistaken his craft for one of those sacred Heinz 57's, and long live the intent cordial.

There is a limit to the length of time an aeroplane, especially a big one, should stand idle on the arrival platform after coming in. That limit should be the time, neither more nor less, that it takes to unload and clear the aircraft and to clap a tractor to its tail and thereafter move off.

Things are getting slacker with certain people, and I frequently observe that all inner berths near the passengers' entrances to Customs are occupied by aeroplanes, great or small, which came in some time before, have long been unloaded, and are merely waiting for tractors. During this period other machines arrive and have to take outer berths at considerable inconvenience and, in wet weather, to the downright detriment of all concerned.

It is a matter that badly needs organising, for you cannot expect tractor crews to know or care when aeroplanes of other firms are coming in and when they suddenly see a liner landing they often create confusion worse confounded by setting off to tractor-tow a big liner away in a wide sweeping curve under the bows of the incoming machine.

Shattering Change

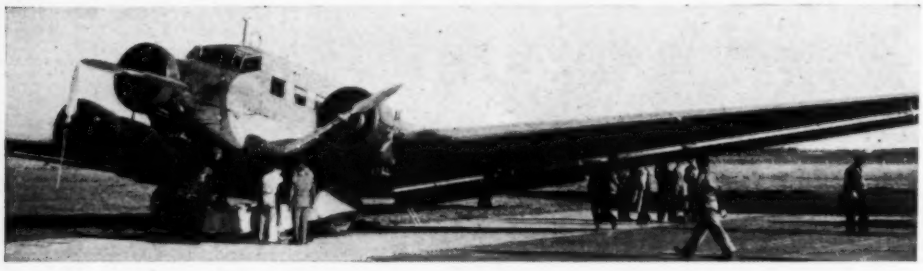
When I come to the Airport these days I exchange the trilling of the robin outside my bedroom window for the jolly trill of a bloke with a road drill who is having all-day fun and games almost immediately underneath my office window.

Thus do Works and Bricks get some of their own back, but I would have them know that their war of nerves won't get me down so long as I drink Booboo, the super-fatted wholemeal stout, and, what's more, the pen is mightier than the drill and wins in the end. The fun I get out of it is to watch the operator of this mechanical disseminator of uproar look up from his work with an expression of pained indignation at any aeroplane which happens to run up an engine or two on the tarmac in his vicinity.

Such is the chaos here at the moment that usually well-informed circles are doubtful whether some of the immense pits being dug are not mere errors of judgment to be shamefacedly filled in again when the missing plans, which keep getting left in cars and lost, are finally recovered and consulted.

A. VIATOR.

COMMERCIAL AVIATION (CONTINUED)



PATAGONIAN EXPRESS: The ubiquitous Junkers Ju.52 in South America. One of Aeropostale Argentina's machines at Buenos Aires before leaving on its long-distance run to Rio Grande in Tierra del Fuego.

Ready for the Tasman

WHILE the two otner Tasman boats, *Awarua* and *Australia*—the latter was recently seriously damaged at Basra—have been flying on the normal Empire routes, the third boat, *Aotearoa*, left last week for Auckland, carrying a number of ground engineers. This boat which, with the others, was fitted with special long-range tanks, will follow the usual route to Australia and should be in New Zealand by August 27. It is in charge of Capt. J. W. Burgess, who is one of the pilots assigned to the Tasman Sea service.

The Third Crossing

WHEN we went to press last week the second Atlantic boat, *Cabot*, which was in charge of Capt. D. C. T. Bennett, had just reached Port Washington, New York. This machine left again on Wednesday of last week and took off from Botwood, for the actual crossing, on Thursday afternoon, carrying the Imperial Airways' manager for Newfoundland.

Cabot left at 9.5 p.m. (B.S.T.), was refuelled, and reached Foynes at 9 a.m. after a flight lasting five minutes less than twelve hours. Southampton was reached at 12.55 p.m. (B.S.T.) on the same day, Friday. *Caribou* made its second crossing during the week-end, and reached New York at 5.25 p.m. (B.S.T.) on Sunday.

Nothing New . . .

WHEN it was suggested, directly by various people and indirectly by Imperial Airways themselves, that Service machines and crews might, in the present hiatus, be used to carry some of the Empire mail, the fact that, long ago, the Civil Aviation section of the London Chamber of Commerce had made a similar suggestion was rather overlooked. In April it was strongly urged by the Section not only that passengers and mail should, as we have repeatedly urged, be separated, but that, as a temporary measure, machines such as the Vickers Wellington might well be adapted for the carriage of mails.

Three weeks later the Air Ministry replied to the Section, saying that they entirely disagreed with the suggestion. Now, it appears that the Air Ministry is to set up a committee to consider the "practicability" of such a course.

Another British Airways Loss

CURIOUSLY soon after a similar accident to a Lockheed Fourteen on the Zurich run, a British Airways' Lockheed 10A caught fire when flying over the Storstroem Straits, some sixty miles south of Copenhagen, on August 15. The pilot put the machine down on the water near the Storstroem bridge, managed to extricate himself from the control cabin, in which the flames were already intense, but was unable to open the passenger door before the machine sank. The four passengers, including Mr. A. C. Crossley, M.P., as well as the wireless operator, Mr. A. S. M. Leigh, lost their lives.

Immediately afterwards there were a number of rumours to the effect that the fire had possibly been caused by sabotage, but nothing in the way of direct evidence to prove this statement has been forthcoming. According to reports, the Danish investigators found that the fire started at the bulkhead behind the wireless cabin and, though it is difficult to understand why the machine burnt so fiercely, it seems more likely that the accident was caused by a short-circuit.

Incidentally, rather more information is now available about the fire on the Lockheed Fourteen. Apparently the fire, which started in the port engine, was successfully put out by the extinguishing equipment, but during the descent into the emergency aerodrome it broke out again; this time, of course, there was no means of extinguishing it.

Italian Preparations

LED by Col. Biseo, of the Italian Air Force, an aeronautical mission, including personnel from Ala Littoria, has recently left Italy for the Cape Verde Islands. The mission, which will have its centre at Pedra de Lume, will survey the islands with the idea of establishing a base for use by the projected Italian service to South America. In the meantime, we must apparently wait until 1943 for our own American service.

The New Atlantic Company

IT may be remembered that when the Atlantic mail and passenger scheme was first worked out it was decided that a company should be formed to include Great Britain—in the shape of Imperial Airways—Canada and Eire. Although British Overseas Airways Corporation is to be formed after the liquidation both of Imperial Airways and British Airways, the Atlantic company will still, for the time being, be known as Imperial Airways Atlantic, Ltd., and will be in much the same position as Qantas Empire Airways. In due course B.O.A. will hold 51 per cent. of the shares in the Atlantic company, with Canada and Eire holding 24½ each.

Reciprocity in North America

FOR some time United Air Lines, the American company, has been flying Seattle and over the border to Vancouver in Canada, though, until now, there has been no reciprocal agreement between the two countries.

Last week-end such an agreement was signed on one side by Mr. Mackenzie King, the Prime Minister of Canada, and by Mr. Daniel Roper, the U.S. Minister in Canada, on the other. The agreement gives freedom of passage to the different air line companies after any necessary adjustment by competent aeronautical authorities in the two countries. It will remain in force for two years, or longer, and neither country will impose any restrictions likely to be disadvantageous to the other. In addition, the agreement provides for the setting up of uniform flying safety measures, and the machines used must conform to the airworthiness requirements of each country.

Australia-America

PAN-AMERICAN AIRWAYS, after many months of preparation, are now awaiting the American Government's approval before restarting their New Zealand-America air service, which was interrupted by the loss of the *Samoan Clipper*. Indications are that the service will be in operation before that of Imperial Airways over the Tasman. The last should be started in October, and by that time it may be that P.A.A. are operating a service from New Zealand to Australia as well.

The American company has bases within easy flying distance of Australia, while the Commonwealth Government's approval to an Australian extension has already been given conditionally. The condition being that the approval must be made reciprocal, British and Australian services to be allowed to run by way of Australia to America.

The main reason for the fact that the Commonwealth requires reciprocity is that a P.A.A. service would definitely compete with the trans-Tasman service and its ultimate Pacific link to Canada. The Commonwealth also has in mind the fact that Imperial Airways hold the necessary rights from the French Government to operate a Pacific service by way of Noumea. The problem of competition, it is stated in Australia, might be met by the two companies coming to much the same agreement as that made for the Atlantic crossing. It will be interesting to see if this comes about, for, if it does, it will mean an Anglo-American air route right round the world.

ANOTHER ISLAND AERODROME

No More Golf-course Landings in the Isles of Scilly : The New Aerodrome at High Cross

IT has long since been shown that, at least for the present, the most nearly paying internal services are those connecting the mainland with a holiday centre which can, otherwise, only be reached by sea. Not only does such an air service save a really useful amount of time, but it is also usually a more comfortable means of transport, and holiday passengers, in any case, are more ready to spend a little more. Incidentally, it is to the distinct benefit of airline operators that, while aeroplanes used for short overland services are not necessarily more comfortable than other conveyances, an over-sea passage is usually smooth.

The Scilly Isles service has been no exception to the general rule. Since the first machine of Channel Air Ferries left Penzance on September 15, 1937, for the Isles, rather more than 10,000 passengers have been carried. That first service, incidentally, provided a good proof of the reasonable reliability of air travel even when no useful radio facilities are available. The conditions on that date were fairly appalling, with half a gale blowing and heavy rain falling from low clouds; the service was, nevertheless, run in both directions to schedule, and none of the passengers appeared to complain.

Previously, Channel Air Ferries had obtained permission to use the golf course, and various minor alterations were carried out there to make this course fit for landings. Actually, an approximately "L"-shaped area was offered, and, since it is, after all, a golf course. those few private owners who have landed there may perhaps forgive Channel Air Ferries for charging a very large landing fee. Although everything went smoothly and not too many games were spoilt (or players made to run for their lives), the system could obviously only be a temporary one, and efforts were made to discover a site for a permanent landing ground. Since then Channel Air Ferries have merged with Great Western and Southern Airlines.

Site-finding

The islands which make up the Scilly group are not only extremely hilly and rocky, but the few comparatively flat areas are used for bulb growing, with the result that it was practically impossible to find a really suitable site. The only reasonable one appeared to be that at High Cross and Salakee Down, near St. Mary's. This area, again, was cultivated, and consisted of several separate fields with dividing stone walls.

On March 13 this year everything was settled, with the general goodwill of the islanders and of the Duchy of Cornwall, and work was started by the St. Just Engineering Company. This concern is apparently prepared to tackle practically any work and they were, in fact, responsible for that at the Land's End aerodrome near St. Just. In as short a time as twenty weeks the area was ready for use and the services have been landing there during the past month.

Rather naturally, it is not big, nor is the surface particularly smooth, but the approaches are good, since the site is right on the top of a hill and the runs (N.-S. 500yd., N.E.-S.W. 360yd., E.-W. 400yd. and S.E.-N.W. 440yd.) are ample for safe operations with a D.H. Dragon. When there is no wind—a condition rarely experienced in the Scillies—the maximum run can be used, and in other circumstances the best use is made of the fact that the aerodrome is conveniently shaped like an inverted saucer.

When, last week, we flew over with Capt. E. G. Parsons in a Dragon, conditions were just about as difficult as they could be, with a wind which was just too strong for cross-wind work and blowing from the worst direction. Nevertheless, with a fairly ample load the Dragon was put down and stopped with a good 100yd. to spare, and the take-off, later, gave no reason for doubt. The scheduled time for the service is about 20 minutes—less or more, according to wind conditions.

At present there are no D/F facilities either at Land's End or on the Scillies, but the company has worked out a very satisfactory safety system involving the use of a transmitter on the machine and receivers at each aerodrome. The pilot gives his approximate position, and if, by any unlikely chance, serious trouble either with the machine or with the weather is experienced, a rescue system can be brought into operation in a matter of 10 minutes or less. The distance between Land's End and the Scillies is only 30 miles, and the need, therefore, for D/F facilities is not by any means urgent.

Incidentally, the aerodrome at Land's End is very much bigger and smoother than is generally imagined. At present it is approximately "L"-shaped, with a maximum run of 700yd., but the "corner," so to speak, of the "L" is now being prepared and will, in due course, be included in the total area.

Informal Ceremony

Last Wednesday a little lunch was given at St. Mary's by Great Western and Southern Airlines to mark the occasion of the opening of the new aerodrome. The general manager of the company, Capt. the Earl Amherst, M.C., was in the chair—if so it can be called, since he himself insisted that the affair was very informal. This luncheon, as Lord Amherst mentioned in his remarks, also gave the company a chance to thank all those who had helped in the arrangements for, and the laying out of, the landing ground. He explained how the service had been run since September, 1937, and how more than 10,000 passengers, 150,000 lb. of baggage, 18,000 lb. of freight and 5,000 lb. of newspaper had been carried by Channel Air Ferries and Great Western and Southern Airlines since that time.

He thanked the golf club for their patience and said that, although not perfect, High Cross was the best possible site. Within limits imposed by weather, the service was run very regularly, and he suggested, though not in so many words, that eventualy they might have D/F facilities there. At this season of the year, particularly, the directors of the company were extremely busy and he apologised for the fact that none of them could manage to be present.

Although Lord Amherst made it abundantly clear that he did not intend his remarks to be treated as a speech and that there were, in fact, to be no speeches, various local notabilities not unnaturally felt that a few words should be said. Their necessary contributions to the proceedings were notably short, and everyone seemed to feel that both the air service and the new landing ground were, if not unalloyed advantages, at least essential facilities for the Isles.

NEW OVERLOAD: Two Harrow bombers, one outside and the other inside the hangar, which are used at Hattie's Camp, Newfoundland, for the air refuelling of the Short boats used on the British Atlantic mail service. Only one is actually needed, but the second has been shipped over for use in case of emergency or minor accident. For *Caribou's* initial return crossing the refuelling equipment was not used, as a following wind and good conditions meant that the machine would reach not only Foynes, but also Southampton, without the necessity for topping up.

Commercial Aviation

In the West Indies

FOLLOWING a considerable increase in traffic, K.L.M. have decided to increase the frequency of their West Indies service between Barbados and Trinidad. Previously this was operated three times weekly; it is now being run four times weekly, the additional service being run on Wednesday so that passengers by ship from New York, arriving at Barbados on Wednesday, may reach Trinidad the same day. Incidentally, during the last two months the K.L.M. staff at Hato airport, Curaçao, have been fitting the company's four Lockheed Fourteens with the new fixed "letter-box" slots.

Interesting Re-equipment

BRITISH-AMERICAN Air Services, a charter firm which specialises in race-meeting work from Heston, has recently bought (and now taken delivery of) a Fokker F.22. This machine, a medium-large high-wing monoplane transport with four Wasp Juniors, was previously owned by K.L.M. and has been used during the last year or two for joy-flying at Schiphol. There was a chance that Scottish Aviation might have taken it over for their projected night mail service between London and Grangemouth.

British Airways, following the loss of a Lockheed 14 on the Zurich run, have bought K.L.M.'s remaining European Fourteen. Four others are used by the company's West Indies section.

The Mozambique Accident

ON May 1 this year one of the Imperial Airways "C" class boats, *Challenger*, was involved in an accident in Mozambique Harbour in which two members of the crew were killed. According to the report of the Air Ministry Accidents Department, the machine was a little behind schedule on its arrival, though flying on a normal course at a low altitude. The commander, therefore, did not make a circuit, nor make use of the appropriate alighting area, but attempted to put down directly into wind straight off his course and across the narrow part of the harbour—evidently with the intention of finishing his run in the vicinity of the mooring buoys.

After the flaps had been lowered and the machine was almost ready to touch down, the commander realised that there was an insufficient length of run if the pier was to be avoided. He ordered "flaps in" and opened the throttles. Unfortunately, *Challenger* then touched and bounced to a height of about ten feet, fell back on to the water (which was so shallow that the keel struck the bottom), rose into the air a second time, and finally stalled and crashed into four feet of water, coming to rest on the sea bottom.

As a result of his investigations, the inspector came to the conclusion that all the circumstances were normal, and that the accident could only be attributed to "gross errors of airmanship on the part of the commander of the flying-boat." Apparently none of the rescue services provided by the Portuguese Government had failed, and the post-accident operations were carried out with proficiency and despatch. The normal flying ability of the commander with Empire boats was not doubted.

Another K.L.M. Trip to South Africa

TOWARDS the end of October a K.L.M. D.C.3 will leave Amsterdam on a special flight to South Africa. The idea is to improve the commercial relations between Holland and the Union. The party, including business men and tourists, will stay in South Africa for about a month before making a return journey.

It may be remembered that in December of last year a K.L.M. D.C.3 made a similar special flight, and probably the very same machine will be used for the October flight. It will be flown by Capt. Blaak, who joined K.L.M. in 1929.

Australia's Surcharge

THE Australian air mail postage rate is the highest in the world—5d. having to be paid for every half-ounce of mail travelling either within Australia or to the rest of the Empire—and there seems little hope of it being brought down to a more reasonable level. The Australian Minister for Civil Aviation, Mr. Fairbairn, indicated some time ago that the 5d. might be reduced to 2d., but a departmental report which has just come out advises Mr. Fairbairn against the decrease.

The report shows that if the charges were decreased the loss of revenue to the Federal Government would be about £300,000 a year. The Ministry is not prepared to stand this loss at a time when it is spending millions on defence, and very shortly it is expected to announce its rejection of the 2d. plan. If, however, the Ministry decides to retain the 5d. charge, it is believed that it will have to postpone the proposal to establish night air mail services between the States, since the volume of mail carried would not warrant the extra expense. The charge affects the Government because it receives the revenue from the Postmaster-General's Department.

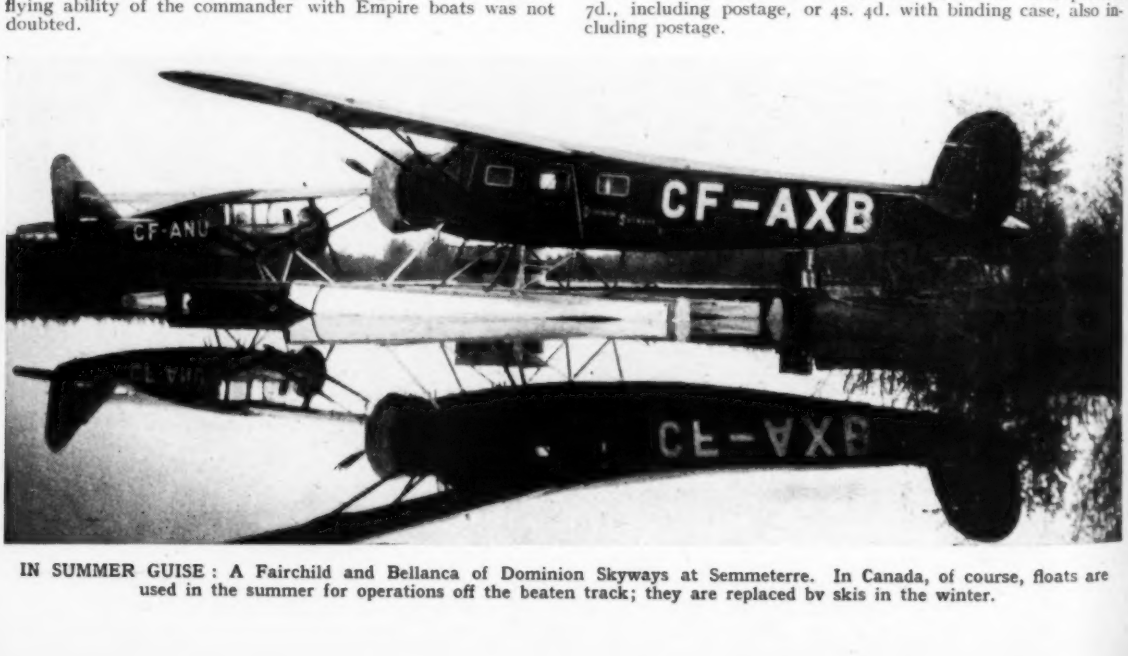
THE KING'S CUP RACE

THE issue of *FLIGHT* for September 7—a fortnight hence—will not only contain detailed and fully illustrated reports of the King's Cup Race and the Wakefield Trophy Race, but will constitute our annual special ***Light Aircraft Number.*** Sections will be devoted to a review of the private-owner and club aircraft on the British market and to a directory of the clubs and schools.

THURSDAY WEEK FLIGHT ***SEPT. 7***

"Flight" Index

COPIES of the "Flight" index for January to June, 1939, are now available from the Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1. The price is 7d., including postage, or 4s. 4d. with binding case, also including postage.

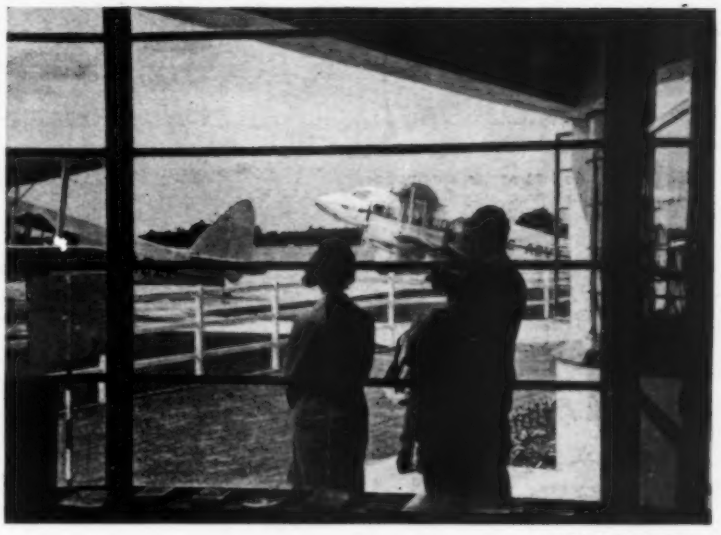


IN SUMMER GUISE: A Fairchild and Bellanca of Dominion Skyways at Semmeterre. In Canada, of course, floats are used in the summer for operations off the beaten track; they are replaced by skis in the winter.

Topics of the Day

SOME BAD WEATHER

—and Two Resulting Obsessions : "Indicator" on Radio and Range



"Flight" photograph.

AFTER a week-end in which I spent most of my time over railway lines and other earnest landmarks at a height of not more than five hundred feet (while everyone else appears to have been flying under cloudless skies), I have two special obsessions. One is concerned with the paramount importance of range in all light aeroplanes, and the other with the still doubted value of a radio receiver equipment.

I seem to remember writing fluently and at length from time to time about the need for both, but not until now have I fully realised that the two are so closely connected. Without range, any sort of receiving (and/or D/F) equipment is not of much value, and without receiving (and/or D/F) equipment range is somewhat wasted, though it can still be very useful.

Whenever simple receiving equipment is mentioned in a casual way people always wonder in a loud voice what its value can possibly be. Once again I can only remind them that there is a perfectly good weather broadcast from Borough Hill, Daventry, practically every hour. At fifteen minutes past the hour (with exceptions) there are regular reports from practically all the aerodromes in the country. They are concerned with the state of things at these aerodromes only a quarter of an hour before. Additionally, forecasts for the whole of the British Isles are transmitted several times during the day at a quarter before the hour. The forecasts may or may not be accurate, but the reports come straight from the aerodromes, and, as statements of depressing fact, can be relied upon.

Lack of Information

Of course, you can land at some aerodrome, when in doubt, and ask for the necessary information. This is very rarely available, and it is usually necessary either to put through an expensive call to the Air Ministry (who are always helpful), or to ring up one's destination (which is a doubtful advantage, since the intermediate conditions are still unknown).

With even the simplest of receivers in the machine, one could either tune in at the appropriate time while flying in moderately good conditions, or, if things are really bad, land at any aerodrome, tune in, and make up one's mind without the doubtful help of the bar attendant's or subassistant ground engineer's idea of weather conditions at one's destination. Given the facts, we are all quite ready to make up our minds. Without them we either rush off down a railway line with unreasonable and quickly shattered optimism, or we stay just where we are and give it all up.

I believe that one of the better-known radio manufacturers is shortly to produce an inexpensive D/F receiver. The emphasis is on the receiver, but the loop could be very useful. The other day I was forced to fly at no height at all under a very thin low-cloud base. I daren't climb through it (though it was only a few hundred feet deep) because I had no definite guide, and, more important, because I didn't know whether it persisted to my destination. In fact, I did travel some fifty miles up above in the sunshine, but eventually I had to come down because the few gaps were rapidly closing, and I could not know what to expect later on and could not be sure that plain D/R navigation would keep me safely over reasonably low ground.

As it happened, the destination was in bright sunshine under a practically cloudless sky. I could have stayed above quite safely. Engine failure at four hundred feet underneath would have been little or no more dangerous than engine failure above it. Given a receiver, I should have known about my destination, and, given the most primitive of homing equipment, I could have carried on to some known destination before dead-reckoning my way over a fairly simple few miles. Probably D/F fixes would have been extremely and dangerously incorrect. That depends on the installation. D/F, in any case, will not be really valuable to the private owner until all club and private aerodromes have transmitters working constantly on some legally permitted and exclusive wavelength. Since nobody is interested nowadays in the private owner, nothing whatever will be done.

Safe Returns

Range is essential, of course, whether you have radio or not—unless, of course, you are prepared to fly round an aerodrome, or only when the weather is stably perfect, or near perfect. A day or two before the enforced low-flying trip I set off, in weather which gave no cause for doubt, for an aerodrome more than a hundred miles away and separated from me by a more or less real mountain range. When I got there I found it to be covered with a sea fog. With only a short range I should have had to go straight back—possibly forced-landing in a field on the way. As it was, I could safely go back into the hills and try another aerodrome on the same coast. The fact that this was also under the weather is neither here nor there. I still had enough fuel to get back to my point of departure over country which was clear though not fit for anything better than an expensive, if personally harmless, landing.

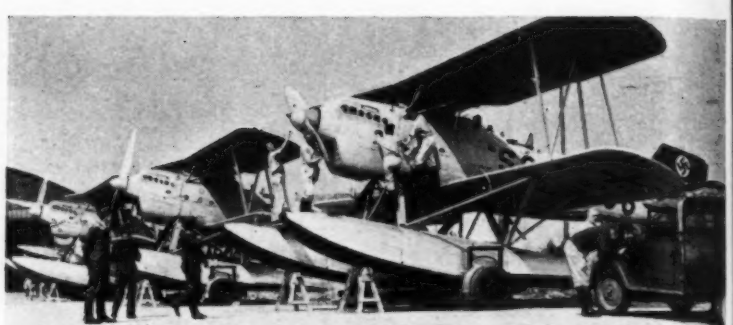
In a sentence, nothing is quite so comforting as the sight of gauges which show hours of flying. Particularly when you have just been severely shaken. It gives you time to think and decide on the next move. I know you should never be trapped by weather, but the fact remains that we all are from time to time.

INDICATOR.

Heinkel He 60 two-seater reconnaissance machines practising formation work over the Baltic

BALTIC TRAINING STATION

Seaplane Training at Kiel-Holtenau



Servicing a flight of Heinkel He 60s at Kiel-Holtenau. This type has a B.M.W. VI engine.

KIEL to Germany is what Portsmouth is to England. Situated at the southern end of Kiel Bay, 70 miles from Hamburg, it has a splendid harbour which was once the base for some of the biggest ships of the former German Empire.

To-day, along the shores of that great bay which is an indentation of the West Baltic in the coast of Schleswig-Holstein, stretching for forty miles from Schleimuende to the Island of Fehmarn, the ships of the German Navy are to be seen once more.

Kiel-Holtenau is now a base of the German Naval Air Arm, and pictures on this page show some of the training activities on the station. The types of aircraft illustrated are the twin-engined Heinkel He 59 and the single-engined He 60. These types are obsolescent and are now used for training, although they were employed in the Spanish conflict. They are being replaced by such up-to-date machines as the Heinkel He 115 twin-engined monoplane floatplane with B.M.W. radial engines.

Large numbers of the military version of the Dornier Do 18 twin-diesel flying boat are in use as reconnaissance machines, and it is believed that a version of the Dornier Do 23 is in service. Unlike the machines of the type supplied to Holland for use in the Netherlands East Indies, this machine has liquid-cooled engines, probably Daimler Benz D.B. 601s or Junkers Ju 211s.

It will be learned from the photographs on this page that Germany, like ourselves, makes use of "flying classrooms" for instruction in navigation, wireless, etc. According to a caption accompanying these pictures when received they give a good idea of the base at Kiel-Holtenau, "over which waters England expects in time of hostilities to meet the air armada of Germany, and certainly upon whose surface naval engagements have not yet finished if ever again the two great naval nations are permitted to unearth the hatchet that was buried for all time in 1919."

The crew of a Heinkel He 59 twin-engined floatplane, which is fitted with two B.M.W. VI engines

Navigation instruction in the cabin of a Junkers Ju 52 seaplane which is used as a "flying classroom."

LARGEST in the WORLD

Air Minister Inspects New Drop Hammer

REDDITCH was the scene, last week, of an interesting ceremony, when the Secretary of State for Air, Sir Kingsley Wood, "inaugurated" the largest drop hammer in the world and inspected the new factory built there for High Duty Alloys, Ltd., of Slough. Before cutting the tape which released the control wheel of the hammer Sir Kingsley spoke to the workpeople and thanked them for their contribution to national preparedness. He then turned the wheel and set the giant "tup" in motion.

Made by the Erie Foundry Co., of Pennsylvania, U.S.A., the drop hammer has a total weight of 455 tons, of which the anvil accounts for 360 tons. The hole that had to be dug for the 1,800 tons of concrete which forms the foundation was 37ft. deep and 39ft. in diameter, and the anvil blocks are buried in the concrete to a depth of 14ft. The photograph gives some idea of the height of the overground part of the drop hammer, the tup of which weighs 29 tons. While visitors watched, the hammer pounded a lump of light alloy into the shape of an engine crank case cover with a few blows.

The new factory at Redditch will, when completed, cover an area of more than 20 acres. Already many of the shops are producing stampings and forgings at a very creditable rate, and when the factory is fully equipped it will contain, apart from the Erie drop hammer, forging hammers from 3 to 50 cwt., and drop stamps ranging from 7 cwt. to 8 tons. A laboratory for exercising production control is provided for, but actual research, and check testing, will continue to be done in the parent laboratories at Slough.

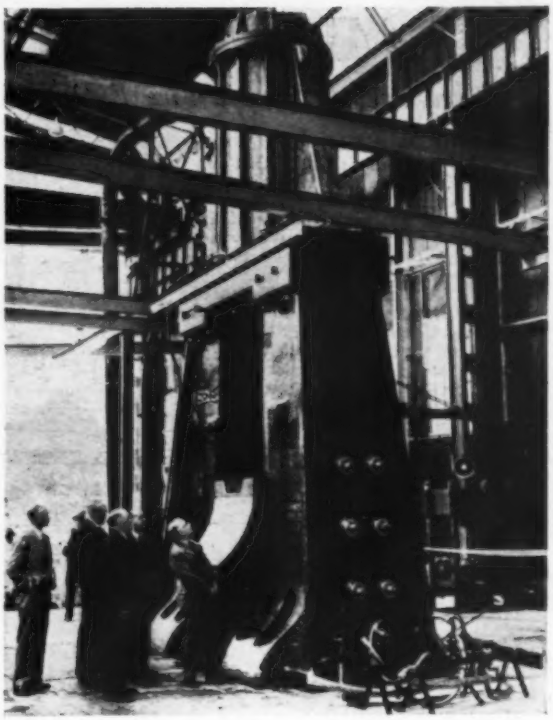
Already the works are equipped with numerous drop hammers and their concomitant heat treatment furnaces and air compressor plant.

Research

At the luncheon which followed the inspection of the new works Sir Kingsley Wood paid a tribute to the contribution of High Duty Alloys in general, and Mr. Devereux in particular, to supplying the needs of the aircraft industry, whose consumption of light alloys is now very vast. It was, he said, the fashion to say that this country was behind in matters of science, invention and research. That was not so, and among those who had placed research in the front rank was Mr. Devereux.

Mr. W. C. Devereux said his company took the greatest pride in having been able to fulfil the industry's requirements in a time of great need. After his return from a visit to Nuremberg in 1937 they extended the factory at Slough, inspired and prompted by the vast activity he had witnessed in Germany. For a time Slough was large enough to cope with requirements, but in time that threatened to become too small, and the Redditch factory was established.

He recorded the indebtedness of his company for the help it had received from the whole British aircraft industry, and in particular he expressed thanks to Mr. Fedden of the Bristol company, Mr. Hives of Rolls-Royce, Mr. Gouge of Shorts, and "little Barlow" of Faireys. "We on the outskirts of the aircraft industry," Mr. Devereux continued, "know that in Sir Kingsley Wood we have the right man at the head."



The Immovable Object and the Irresistible Force: The Air Minister admires the Erie drop hammer recently installed at the new Redditch works of High Duty Alloys, Ltd. Behind him is Mr. W. C. Devereux.

The expansion of High Duty Alloys, Ltd., has been entirely a private enterprise, and Mr. Devereux very naturally expressed some concern about what was going to happen to such firms in view of the competition from Government-subsidised factories when the present expansion came to an end. He recalled that he used to do export business to the tune of about £350,000, a figure which was now down to a small fraction. Firms could do something by being ready with new materials, new applications and new ideas, but competition from subsidised plant was a worrying thought.

Mr. H. G. Herrington, general manager of High Duty Alloys, said that the success of the company was due to close co-operation between it and the industry and Air Ministry. The assistance which they had had from the National Physical Laboratory (Dr. Desch was sitting next to him) was not overlooked. He paid a tribute to "the inspired leadership of our chief" (Mr. Devereux), whose enthusiasm and energy he (Mr. Herrington) could only admire and envy. However, so long as his hat fitted him, they could forgive their chief anything. He paid a warm tribute to their chief engineer, Mr. McKenzie, who had got up from a sick bed to make sure all was in readiness for the Air Minister's inspection.

Materials

Mr. E. W. Hives, of Rolls-Royce, Ltd., said it was very easy to overlook the advantages of high-class materials. The supplier of materials had to sell his wares to hard-boiled engineers who did not believe his curves! When he succeeded in convincing them that the curves were correct they at once set to work to devise new tests to show that the material was not all that was wanted.

They had to admit that most of the increase in performance obtained with modern aircraft and engines was due to better materials. Although there were many types of engine—some round, some square, some wet, and some dry—no one type could claim sufficient superiority to exclude the rest. This was really due to the fact that they all used the same materials. The alloys produced by High Duty Alloys were equal to anything in the world, and he had heard that now Mr. Devereux was going to produce magnesium from sea-water and so make the country independent of import.

Mr. Devereux, Mr. Hives concluded, was the opposite to Pobottle's foreman. He never said anything that could not be done. He had made a profit, but no one would begrudge that, as he was sure to spend it on a bigger hammer or a better laboratory. A small morsel of the profits might go to improved farming or even to hunting.

Mr. Arthur Gouge said that in modern aircraft some 60 or 70 per cent. of the unladen weight was light alloy. This showed the extent of the responsibility of a firm like High Duty Alloys. There was no better firm anywhere. He thanked Mr. Devereux for his work on magnesium alloys, as a result of which we were beginning to take away Germany's lead. He recalled that all the guests had seen at Redditch that day was a result of private enterprise, and he expressed the hope that this country would always continue to depend upon private enterprise.

Speed on Water

SIR MALCOLM CAMPBELL broke his own water speed record on Coniston Water last Saturday by achieving a mean speed of 141.74 m.p.h. over a measured mile. His engine was actually one of the Rolls-Royce R.2s used in the Schneider Trophy Contest eight years ago. Using Esso Ethel fuel, the engine was developing slightly under 2,000 b.h.p. at 3,250 r.p.m.

MINIMISING FIRE RISKS

Fixed and Automatic Fire Extinguishing Methods to Meet New Regulations

TOWARDS the end of June this year the Air Ministry decided that aircraft with certificates of airworthiness in sub-divisions (a), (b) or (c) must be equipped with fire extinguishers of approved types installed so that they can be operated from the cockpit to extinguish fires in the engine nacelle or nacelles. This decision was announced in the *Air Ministry Notice to Aircraft Owners and Ground Engineers No. 19 of* 1939 and is applicable to all new-type aircraft whose C. of A. application was received by the Air Ministry on or after August 1, 1939. The notice then goes on to mention the names of two companies which make approved fire extinguisher equipment—The Graviner Manufacturing Co., Ltd., First Avenue House, High Holborn, W.C.1, and The National Fire Protection Co., Ltd., 18, Petersham Road, Richmond, Surrey.

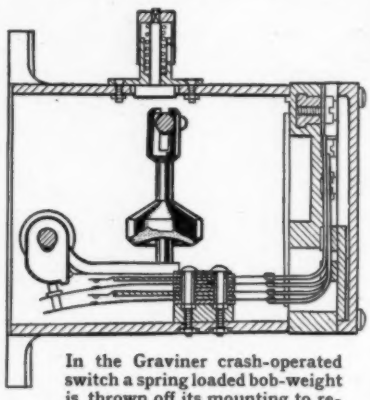
Owing to an oversight another company's name, The Walter Kidde and Co., of Belvue Road, Northolt, Middlesex, was omitted, but a suitably amended notice is to be issued by the Air Ministry in the course of a few days.

For a number of years Farnborough has been co-operating with these manufacturers and has, as a result of prolonged tests, approved a system whereby fire in the engine nacelles can be dealt with by the pilot with the aid of a push-button control. In the main the three companies employ the same method, though with certain variations. To meet the new regulations the aircraft must be equipped with an extinguishing bottle containing either methyl-bromide or carbon dioxide compressed into liquid form. These gases, incidentally, do not have any harmful effect on the engine parts. Special perforated pipe lines lead to those points most likely to be a source of danger in the event of a crash or a fire in the air, such as the air intake, the carburettor, and the rear cover with accessories. The extinguisher is set into operation electrically by the pilot, who is able, by pressing the button mounted in his cockpit, to fire a cartridge which breaks the seal of the extinguisher bottle and allows the extinguisher medium to flow through the pipe-lines on to all the vulnerable parts of the engine.

The new regulations do not insist on any automatic means of operation, but each of the three companies have devised self-actuating methods.

* * *

The Graviner Manufacturing Co. offer three ingenious switches which will operate one or more methyl-bromide extinguishers almost instantaneously in the event of a crash or if the aircraft turns on its back while landing, while if fire breaks out in the air the system will also automatically come into operation. The first of these three switches is crash-operated. It is contained in a small moulded box and weighs 1lb. 1½oz. The switch is operated by the release of a small bob-weight which will spring out of its mounting in the event of a crash. It can be set to varying values of *g*—the acceleration due to gravity. For Service aircraft this is fixed by the Air Ministry at 6*g*. The second switch ensures that the extinguishers will automatically discharge in the event of the aircraft turning over on to its back when landing. Under these conditions the impact might not be sufficient to release the crash-operated switch. This switch, incidentally, will operate only when the undercarriage has been lowered.



In the Graviner crash-operated switch a spring loaded bob-weight is thrown off its mounting to release a trigger that operates electrical contacts.

The third switch in the Graviner system is a flame detector, which should be mounted behind the air intake of the carburettor and also to the cover behind the engine. This switch, which weighs 9oz., incorporates a special fuse which, on coming into contact with a flame, will ignite and release a spring loaded plunger; this, in turn, immediately operates the electrical circuit. It will also operate at temperatures exceeding 150 deg. C. In addition to this fuse there is a thin strip of highly inflammable celluloid. Incidentally, this switch was subjected to prolonged immersion tests before it was accepted.

The Graviner flame detector.

It should be mentioned that in the case of all three switches, the pilot can still operate the extinguisher, if he wishes, by pressing the push-button specified in the new regulations. This automatic Graviner system is now being standardised on R.A.F. aircraft.

* * *

Automatic operation is secured by two independent methods, and direct manual operation is also provided for, in the system devised by **The National Fire Protection Co., Ltd.** In the event of a crash an ingenious impact gear comes into operation. It consists, basically, of two toggle links threaded on a short length of catgut. As long as they remain in a straight line with one another they hold a spring-loaded electrical contact off its seating. They are arranged in such a manner that an ordinary vertical landing shock will not have any effect on them. However, in the event of a shock in the horizontal plane they collapse and allow the switch to close. They may instantly be reset by pulling the gut string taut. An adjustment of the spring tension is provided to secure operation at any predetermined value of *g*. This impact switch is usually fitted at the rear of the engine nacelle.

The second unit is a flame switch, two of which are usually fitted, at the most vulnerable points. The flame switch consists, in effect, of an inflammable link which, on being touched by a flame, instantly flashes off and releases a contact to close the electrical circuit.

Thirdly, as has already been stated,

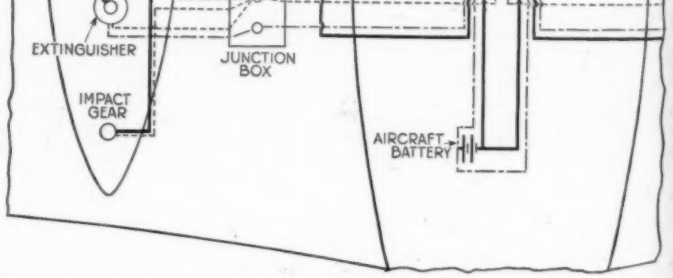
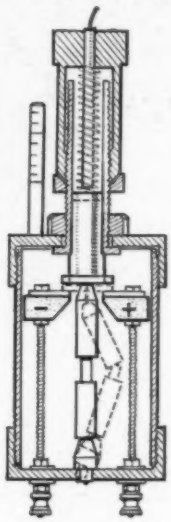


Diagram of the National Fire Protection Company's installation for a twin-engined aircraft. The starboard side is identical.

the pilot can press a button and complete the circuit independently of the automatic devices. In each case the effect of completing the circuit is, of course, to fire the cartridge and release



The National impact switch in section, showing (by dotted lines) how electrical contact occurs in the event of a crash. The collapsible elements can be instantly reset by pulling taut the central gut string on which they are threaded

the methyl-bromide under pressure in the extinguisher. An indicator light on the dashboard shows the pilot that the circuit has been closed and that the extinguisher has operated. The system is obviously capable of easy adaption and duplication to suit any number of engines. The weight of a typical installation is 14 lb. per engine.

* * *

In 1935 **The Walter Kidde Co.** devised the fixed method of fire extinguishing equipment, i.e., pipe-lines from an extinguisher lead to danger points, the system being controlled by the pilot. In the case of this company, however, the medium used is highly compressed carbon dioxide.

Apart from the manually operated system, Walter Kidde and Co. supply a flame detector in which highly inflammable celluloid is employed to release the switch that operates the electrical circuit controlling the release of the gas. This company also manufactures a fuse-type switch for flame detection.

It is interesting to note that their standard system is being fitted to the new De Havilland Flamingo type.

BROTHERS? On the right Capt. Eddie Rickenbacker, well-known American war pilot and aviation authority, laughs with Capt. Cyril F. Uwins, Bristol chief test pilot, on the occasion of the former's visit to the Bristol works.

EIGHTY-EIGHT YEARS OF GEAR-CUTTING

THE manufacturer who "places out" orders for his gearing requirements can never be accused of acting unwisely, for the production of gears is the work of a specialist, whether the order be a large or small one.

Gear cutting, like metal spinning, is still very much an individual craft. Consequently, when we paid a visit last week to the works of Beard and Fitch, Ltd., we expected and found a large number of skilled and experienced craftsmen operating batteries of highly specialised machines engaged in the production of all types and sizes of gears.

Beard and Fitch, Ltd., was originally founded in 1851 by the father of the present managing director, Mr. C. T. Beard. During the course of time Mr. Beard has accumulated a staff of men and expert operators whose workmanship has enabled the firm to progress steadily through all boom and depression periods.

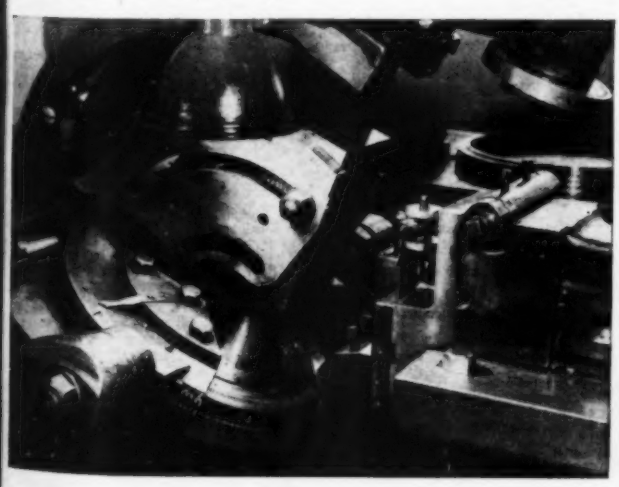
Just recently the company has extended into new premises in Britton Street, Clerkenwell Road, London, E.C.1, where it occupies three floors. In the basement all raw materials are neatly stored in shelves. On the ground floor are batteries of heavy shapers, millers, bevel gear generators, grinders and hobbing machines. All instrument and light gearing is dealt with on the first floor, where there is a large number of small instrument lathes ranging from three-inch centres upwards. Also on this floor is the drawing office and micro-projector.

Rather naturally, the more interesting plant is to be found on the ground floor. Here Mr. Beard has erected three Reinecker bevel gear planers. On one of these machines he has carried out a most unusual conversion in which the table has been inverted and inclined inwards to deal with internal bevel gears up to 18in. diameter, and with pitch angles up to 22 degrees. Then there is a battery of three Heidenreich and Harbeck double-action gear generators. This shop is, of course, fully equipped with shapers, 20in. centre lathes, millers and gear hobbers.

Throughout the works a high degree of accuracy is maintained and to this end a Franklin-Carter profile projector has been installed—a remarkably neat instrument which enables the operator to check up to limits of 0.00001in.

It is the aim of Beard and Fitch, Ltd., to undertake all types of gear cutting, no matter how difficult the problem may be, and it is not surprising, therefore, that in the list of aircraft manufacturers and contractors which this company supplies are such well-known names as Vickers Armstrong, Ltd., Fairey Aviation Co., Ltd., and the Parnall Aircraft, Ltd.

(Below, left) An internal bevel gear for the Vickers Wellington is cut on a specially adapted bevel gear planer at the works of Beard and Fitch, Ltd. (Right) A handy Franklin-Carter profile projector installed in the same works.



For Cleaning-up Bolt Shanks

THE usual method of removing the unwanted shank of a bolt after a nut has been tightened down is to use a hacksaw or file. Alternatively a first assembly of nut and bolt can be made, the bolt marked, the nut removed and the bolt then cut to the required length.

With the Desoutter bolt-milling tool the job is assembled and the shank of the bolt is then milled away in position, either flush with the nut or with any predetermined length of shank.

The cutter consists of a twist drill ground flat and mounted in a pneumatic drill. Screwed to the body of the latter and protruding over the chuck is a sleeve on the end of which is carried a spring loaded telescopic nose. Into the nose is screwed a bush recessed so that it locates on the nut of the shank to be trimmed. As this bush is screwed in or out of the nose, so the amount of bolt shank to be milled away or left is regulated.

Normally the cutter leaves the milled end of the bolt ready to be locked by the usual centre-punch method. As an alternative the twist drill cutter can be ground to a slight point so as to leave the shank end slightly hollowed out to enable the end to be tapped with a hammer for riveting it over the nut. The Desoutter bolt-milling tool is available in two sizes—the M.30 for bolts up to ¼ in. B.F.S. and the R.35 for bolts up to ⅜ in. B.S.F.

AN ARLE COURT APPOINTMENT: Mr. R. H. Bounds, A.F.R.Ae.S., has recently been appointed to the Board of directors of Aircraft Components Ltd. Mr. Bounds has now completed 25 years of continuous activity in the aircraft industry since his association with Mr. Pemberton Billing in 1914.

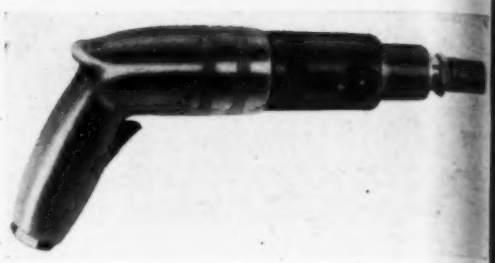
In Brief

An additional point of interest about last week's photograph (p. 149) of the Royal barge passing H.M.S. *Courageous* during the King's inspection of the Reserve Fleet is that the former handsome and speedy craft is from the yard of Vosper, Ltd. Also in the photograph was one of the Vosper motor torpedo boats.

* * *

In our description (August 10) of the Blackburn Skua, the very comprehensive hydraulic operating system for undercarriage and other services was described in some detail. It should be added that the Automotive Products Co., Ltd., of Leamington Spa, are responsible for this equipment.

THE INDUSTRY (CONTINUED)



The Desoutter bolt-milling cutter for removing *in situ* the unwanted shank ends of bolts.

NEW COMPANIES

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AERONAUTICAL PATENTS

(*Published August 10, 1939.*)

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(*Published August 17, 1939.*)

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Aeronautical Research Committee Reports and Memoranda: Report No. 1840; The Lateral Stability of Highly Loaded Aeroplanes, by L. W. Bryant and A. G. Pugsley; 2s. No. 1845: The Protection of Magnesium Alloy Steel Against Corrosion by the Use of Enamels Containing High Purity Chromates, by L. F. Le Brocq; 3s. 6d. H.M. Stationery Office, York House, Kingsway, London, W.C.2.

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